AN ECONOMETRIC STUDY OF BUSINESS DEMAND FOR MONEY IN INDIA 1950-51–1970-71

A Thesis Submitted
In Partial Fulfilment of the Requirements
for the Degree of
DOCTOR OF PHILOSOPHY

By
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to the

DEPARTMENT OF HUMANITIES AND SOCIAL SCIENCES
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DECEMBER, 1974

DEDICATED TO

THE SACRED MEMORY OF MY MOTHER

CERTIFICATE

This is to certify that the thesis "An Econometric Study of Business Demand for Money in India: 1950-51 - 1970-71" submitted by Shri Rajan Kasturi Sampath in partial fulfilment of the degree of Doctor of Philosophy of the Indian Institute of Technology, Kanpur, is a record of bonafide research work carried out by him under my supervision and guidance for the last three years. The results embodied in this thesis have not been submitted to any other university or Institute for the award of any degree or diploma.

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Synopsis

"An Econometric Study of Business Demand for Money in India 1950-51 to 1970-71" - a thesis submitted in partial fulfilment of the requirements for the Degree of Doctor of Philosophy by R.K. Sampath to the Department of Humanities and Social Sciences, Indian Institute of Technology, Kanpur, December 1974.

This is an econometric study of business demand for money in India. It deals with both theoretical and empirical aspects of business demand for money.

At the theoretical level the study first reviews the existing body of literature as contained in the works of classical and Neo-classical economists, J.M. Keynes, W.H. Baumol, James Tobin and Allan H. Meltzer. After this it develops three more models of business demand for money by introducing certain modifications in the above mentioned works. These are the following:

(i) A modified Meltzer model

(ii) A combined Keynes-Baumol model

(iii) A Neo-classical production theory model.

At the empirical level, the study makes an attempt to find out the relevance and significance of the above mentioned models of business demand for money in the Indian context both at the aggregate and disaggregate levels for different types of business concerns described below which are engaged in the production of goods and services. The evaluation criteria are the predictive power of the model, the appropriate algebraic signs for the estimated parameters in accordance with theoretical expectations, their statistical significance and the stability of the estimated parameters over time.

Depending upon availability of appropriate data, both cross-section and time-series analyses have been conducted. The cross-section analysis is carried out only for public limited companies. The time-series analysis is carried out for the above-mentioned aggregates (namely public limited, private limited and Government companies) as well as for 6 broadly classified industry groups of public limited and private limited companies, and for each of the 33 industries of public limited companies. In this context it throws light on the below mentioned problems in monetary economics:

(i) Is there a stable demand function for money? If so, what are the key variables that appear in it?

(ii) If there exists a model of business demand for money which is stable, then does it have satisfactory performance both at aggregate and disaggregate levels?

(iii) Are there differences in the business money demand functions according to

(a) size differences

(b) sectoral characteristics

(c) type of ownership e.g. public limited, private limited or Government companies?

(iv) What roles the variables such as income, rate of interest, wealth, expected changes in the general price level and security prices, the return on physical assets, capital intensity, relative factor prices, wealth-income ratio (a proxy variable measuring changes in business activity) etc., play in the business demand function for money?

(v) What is empirically the most appropriate way of defining money which will provide us with a stable demand function for money?

(vi) What is the relationship between elasticity coefficients at the aggregate and disaggregate levels?

(vii) What is the relationship between cross-section estimates of elasticity coefficients and time-series estimates? Do they give similar or contradictory results?

(viii) Are there inter-industry differences in the business demand functions for money?

The main conclusions that emerge from this study are the following:

(i) The modified Meltzer model which we developed by relaxing some of the assumptions of the Meltzer model, has come out empirically the most appropriate model of business demand for money both at the aggregate and dis-aggregate levels.

(ii) Our study conclusively proves that there exists a stable demand function for money both at the aggregate and disaggregate levels. The arguments in the demand function are the current income, wealth-income ratio and the rate of interest on Government securities.

(iii) Our study also establishes that empirically the most appropriate definition of money for our purposes is the broader definition of money, namely M2 which includes cash balances, demand deposits and time-deposits with banks.

(iv) Our study shows that there are economies of scale in holding cash balances which is evident from the fact that the income elasticity of demand for money is around .70 for the Indian business sector which is neither as low as .5 as predicted by Baumols' model nor unity as predicted by the classical model. Our study further shows that the rate of interest is one of the most important variables in the business money demand function. The interest elasticity of demand for money for the Indian business sector is as high

(v) Another conclusion is that size and pattern of ownership do not influence the business money demand functions in any qualitative way. And also inter-sectoral and inter-industry differences in the money demand functions are negligible.

(vi) Our study further establishes that time-series and cross-section estimates of elasticity coefficients of money demand functions do not show any divergent characteristics. They are consistent with one another.

The data for this study have been taken from the Reserve Bank of India studies on "Finances of Joint-Stock Companies in India", published in the RBI monthly bulletins from time to time.

CHAPTER I

INTRODUCTION

I. Objectives:

1.1. This is an econometric study of business demand for money in India. An attempt will be made to study the relevance and importance of received economic theories of the business demand for money, which were originally developed for such advanced economies as U.S.A., U.K., etc., in understanding the Indian business demand for money, and if necessary, to develop new theoretical models to explain the Indian phenomena.

1.2. Substantially the study will concern itself with such problems which are often posed in 'Monetary Economics' such as the following:

(a) Is there a stable business demand function for money?

(b) If so, what are the arguments in the business demand function for money. In this context we will study the relevance and relative importance of such factors as current income, wealth, rate of interest on Government securities, rate of return on physical assets, wealth-income ratio, price-level, expected changes in the price level and the rate of interest, relative factor prices etc., on the business demand for money. We will also study the controversy regarding the definition of money, the importance of the rate of interest and the relevant

constraint in the business money demand function.

(c) Are there significant differences in aggregate and disaggregate business demand function for money? If so, what are the plausible reasons for it?

(d) Are there inter-sectoral, inter-industry and inter-size differences in the business demand function for money?

Our study will throw light on each of these problems.

II. Methodology:

2.1 In realising the above mentioned objective of finding the most appropriate model of business demand for money which will explain the Indian business money demand behavior in terms of certain key variables, we may face a number of difficulties with regard to the methodology of our approach. We have to decide the following:

(a) Whether our study is going to be an aggregate analysis of business sector meaning thereby a study of 3 main aggregates* of companies according to the nature of

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* Even though we can have a grand aggregate (taking into account all the companies) of the total business sector, we could not do it for two reasons
(i) we have not included Foreign Companies and small private limited companies in our study due to non-availability of data. So without these companies, the total of the above mentioned 3 aggregates can not be called as total business sector. So it serves no purpose by having one more aggregate.
(ii) Secondly eventhough for public limited and private limited companies we have 16 year data (1955-56 to 1970-71) for Government companies we have only 12 years data (1959-60 to 1970-71). Thus we will loose 4 observations for the total business sector.

ownership namely

(i) Aggregate of all public limited companies

(ii) Aggregate of all private limited companies

(iii) Aggregate of all Government companies.

Or

a disaggregate analysis of business sector

Or

a combined study in both the aspects.

If we also attempt disaggregate analysis of business sector, then we have to decide whether disaggregation will be carried out at the sectoral level or industry level or at size level.

If the level of disaggregation is at the sectoral level then following the methodology of the Reserve Bank of India (RBI) studies on "Financial Statistics of Joint-Stock Companies in India", we can divide each of the above mentioned three aggregates into 6 broad sectoral groups namely

(i) Agriculture and Allied Activities (AAA)

(ii) Mining and Quarrying (MQ)

<u>Processing and Manufacturing-Sector</u> (iii,iv,v)

(iii) 'Consumer goods' Industries Sector (CGI)

(iv) 'Capital and Industrial Intermediate Goods' sector (CIGI)

(v) 'Consumer Intermediate Goods Industries' sector (COIGI)

(vi) Tertiary or Services Sector (TSS)

If disaggregation is at the industry level, then, again following the methodology of RBI studies, we can divide each of the above mentioned 3 aggregates into 33 different industries (for a list of these 33 industries see Appendix I to chapter II).

If disaggregation is according to size of firms, then we can divide the aggregates into two main groups as has been done by RBI studies namely

(i) Medium and large companies

(ii) Small companies.

The measure of size will be in terms of paid up capital.

For our purposes we will adopt all these different measures of disaggregation and see what difference they make, if at all they make, to business money demand functions. This complete approach will help us in understanding the primary reasons which are responsible for differences in monetary behavior among industries. This will also help us in understanding the kind of relationship that exists between Macro and Micro functions (or what can be called as aggregate and disaggregate functions) and will help us in finding the extent of aggregation bias that enters into estimation of Macro functions when underlying micro functions are different from one another either in terms of magnitude of estimated parameters or in terms of the variables that enter into the function.

(b) Whether our study is going to be based on

(i) Cross-section data alone

or

(ii) Time-series data alone

or

(iii) On both of them.

Unfortunately both in India (see ref.1) and abroad (see refs:2,3,10,12,14,23,24,& 26) all the studies are either in terms of cross-section data or of time-series data alone. None of the studies tried to compare and contrast the conclusions reached by these two different methodologies. As our purpose here is more of an exploratory study of the nature of monetary behavior of business sector, we can not base our conclusions on the basis of any one particular methodology. We are also interested in seeing whether different methodologies lead to any conflicting conclusions, if so how to reconcile with them. We are also interested in finding out the relationship between cross-section estimates of parameters of equations and time-series estimates of parameters of equations.

There is one more reason for adopting both the methodologies. We have a number of hypotheses which have to be tested, some of which require exclusively cross-section data and some other require time-series data alone. For example the effect of size, the role of income or wealth upon the demand for money can be dirertly tested

by using cross-section data where as to test the effect of variations in the rate of interest or price level upon the demand for money, we require time-series data.

2.2. Thus this study is an attempt to evaluate the relative performance of received economic theories along with a few modified models based on them, in explaining the monetary behavior of business sector in India at aggregate levels as well as at disaggregate levels in terms of size, sectoral and industrial characteristics, utilising both cross-section and time-series approaches to estimation of money demand relationships.

III. The Need:

3.1. The need for this study can hardly be exaggerated, particularly in the Indian context. While a few studies (which were referred earlier) have been carried out for the United States, and other advanced economies, no detailed econometric study has been carried out for India* regarding the business demand for money. Even for advanced economies no such detailed study has been carried out along the lines as we are doing here for India. Different authors using different methodologies have arrived at different conclusions regarding the business demand for money (3,4,10,14,23, & 24). So it becomes necessary both from academic and practical points of view

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* Saravanes' (1) work is not an econometric study.

to assess the relative merits of different schools of thought on this matter and also to find whether something more concrete and general can be said on this controversy.

3.2. Secondly as Harry Johnson has pointed out most of the controversies are "essentially empirical issues, to which empirical research has as yet produced no conclusive answers and they clearly have an important practical bearing on monetary policy" (see ref.29,p.27). And also in another context he says "unless the demand for money-defined to correspond to some quantity the central bank can influence-can be shown to be a stable function of a few key variables, the quantity of money must be a subordinate and not a strategic element in both the explanation and control of economic activity" (see ref.129,p.34). So it becomes all the more important to add new evidence.

3.3. Thirdly as some economists (see ref.9) have argued that there are "a priori" reasons to believe that the business monetary behavior will be different from individual monetary behavior. If this is so, the total demand functions for the economy as a whole which the economists have been concerned with so far, can not picture adequately the particular demand behavior of business sector.

3.4. Fourthly the importance of the business sector in the economy of India, or for that matter for any economy, can hardly be overemphasized. As the economy

develops further and further, the role and size of the business manufacturing sector becomes greater and greater in comparison to other sectors.

3.5. Fifthly this kind of disaggregate analysis will help us in understanding the micro-economic structure of business money demand relationships and thereby will help us in understanding further the aggregate monetary relations. Moreover these micro economic studies are all the more important for such economies as ours where, in the process and interests of development, it becomes essential to adopt discriminatory economic policies, which require an effective understanding of micro economic units to formulate optimal economic monetary and fiscal policies.

3.6. Sixthly purely from an econometric point of view also it is important to analyse the disaggregative behavior of the economy in order to find out the extent of "aggregation bias" involved in the estimation of parameters of functional relationships. Particularly in an economy in which structural changes are occuring in wide disproportion in different sectors and industries, it is not possible to rely upon aggregate or nacro relations alone for formulating effective monetary policies and to understand the extent of structural changes that are occuring in the economy.

IV. Limitations of the Study:

3.1. In realising our above mentioned objectives, we are confronted with many constraints imposed by the data that are available to us. The most ideal way of realising our objectives would be to conduct an Inter-Industry, Inter-Sectoral, Inter-Size, Macro-Micro (in other words aggregate-disaggregate) analysis of each type of business institution namely public, private, and Government companies, using both cross-section and time-series data. Because of non-availability of certain types of data for certain groups we will carry out our analysis as written below.

	Type of Companies	Modes of Analysis carried out
1.	Public Limited Companies	1. Both cross-section and time-series analyses 2. Both aggregate and disaggregate;, disaggregation at two levels (i) Sectoral level (ii) Individual Industry level 3. Inter-size analysis in terms of two categories (i) Medium and large public limited companies (ii) Small public limited companies

2.	Private Limited Companies	1. Only it terms of time-series data analysis. 2. Both in terms of aggregate and disaggregate analysis. But disaggregation is only at the sectoral level. 3. No inter-size analysis.
3	Government Companies	1. Time-series analysis of aggregate data only

V. Plan for the Study:

In chapter two we are dealing with the description of data and definition of variables. Chapter III is dealing with theoretical models of business demand for money. In chapters IV and V we are dealing with aggregate and disaggregate analyses of business demand for money respectively. In chapter VIwe present the conclusions we reach from this study.

CHAPTER II

DESCRIPTION OF DATA AND DEFINITION OF VARIABLES

I. Source and Description of data:

1.1. The main source of data is the Reserve Bank of Indias' (here afterwards referred to as RBI) studies on "Financial Statistics of Joint-Stock companies in India" published periodically in the monthly bulletins of the RBI.

1.2. These studies present data on balance sheet and income-expenditure and appropriation account of the companies.

1.3. In terms of paid-up capital these studies cover a major portion of the corporate sector; as much as 80% of the total. The selection of companies for these studies were made with the twin objectives of maximising, industry-wise, the coverage in terms of paid-up capital and ensuring inclusion of as many representative units as possible from various industries. Newly registered companies, defunct companies and companies which have suspended production are not included in the studies. Companies functioning not for profit, companies limited by guarantee and promotional/ developmental organisations are excluded. This makes our study all the more scientific in the sense that all

the companies included in our study are conforming to the assumptions made in economic theory.

1.4. The basic source of data for the studies is the annual reports and accounts of companies. According to the arrangement made with the Government of India, the Registrars' of Companies forward to the RBI one set of the annual report and accounts filled with them by companies.

1.5. These Joint Stock Companies are broadly divided into 5 groups according to their legal and institutional nature namely

(i) Public Limited Companies

(ii) Private Limited Companies

(iii) Foreign companies which are further divided into

(a) Foreign controlled Rupee Companies (i.e) those Indian Joint Stock Companies which are regarded as foreign controlled in the survey of India's foreign liabilities and assets by RBI.

(b) The branches of foreign companies i.e. those foreign companies whose branches are in India.

(iv) Government companies i.e. companies in which not less than 51 per cent of the paid-up share capital is held by the central Government or

or by any State Government(s), or partly by the Central Government and partly by one or more State Governments, and include a company which is a subsidiary of a Government Company. This does not include financial companies.

(v) Financial and Investment Companies and Statutory Financial Corporations. This category refers to those companies which are engaged mainly in financial activities such as the acquisition of shares, stocks, debentures or other securities, or financing industries by advancing loans.

For our study we do not include the categories (iii) and (v) because of two reasons

(i) For foreign companies data are available only for 9 years. And also the classification of industries and the nature of data available do not follow the same pattern as for the rest.

(ii) Financial and investment companies and statutory financial corporations are not engaged in the production of commodities and services. So they do not come under the scope of our study.

1.6. Now let us look at the type of data that are available for our purposes for the categories (i), (ii) and (iv).

(i) Public Limited Companies: The required data on relevant variables are available for two classes of public limited companies namely

(a) Medium and large public limited companies and

(b) Small public limited companies

The former refers to those public limited companies whose paid-up capital is more than Rs.5 lakhs each, and the latter refers to those public limited companies whose paid-up capitals is Rs.5 lakh or less.

For medium and large public limited companies we have both sector-wise and industry-wise data for 20 years from 1950-51 to 1970-71. These medium and large public limited companies are grouped into 33 industry groups. These 33 industries are divided into six main categories according to their nature of activities and data are available for 20 years for these sub-totals also. (For details see appendix I).

But for small public limited companies only the total of all industries are available and that too only from 1955-56 onwards.

(ii) Private Limited Companies: Even though private limited companies are also divided into 2 main

categories (namely medium and large and small) along the lines of public limited companies, time-series data are available only for medium and large companies. For small private limited companies only five years' data are available. So we are not including them in our study. And also for private limited companies only aggregate and sectoral alone are available. Individual industry data are not available.

(iii) Government Companies: For Government Companies only data on the aggregate of all the companies are available for 13 years from 1958-59 to 1970-71. Sector-wise and industry-wise data are not available.

II. Definition of Variables:

The empirical definition of variables as given by the RBI which are used in our study are described below.

2.1. Gross Fixed Assets (GFA): The gross value of fixed assets, that is, gross of depreciation, is shown in this item. GFA includes land, buildings, plant and machinery and others.

2.2. Depreciation: This represents depreciation provided on fixed assets as defined in GFA.

2.3. Cash and Bank Balances: This includes 3 items

(i) Cash in hand

(ii) Demand Deposits

(iii) Fixed deposits with banks

2.4. Income: This includes the following items

(i) Receipts from sales of the products and services of the company

(ii) Non-operating incomes like interest, dividends, rents, royalties etc.

(iii) Closing stocks of finished items and work-in-progress.

2.5. Wages: This item includes salaries, wages and bonus paid to the office staff and factory workers and some other miscellaneous items.

2.6. Wealth: This is the sum of the following:

(i) Net fixed assets

(ii) Inventories

(iii) Loans and advances and other debtor balances

(iv) Advance of income-tax

(v) Other assets such as immovable properties, intangible assets etc., and

(vi) Cash and bank balances.

2.7. Government Securities: This constitutes of Central and State Government securities.

2.8. Rate of Interest: Time-series figures of the rate of interest on Government securities are the weighted average yields on Government securities of different maturities, the weights being proportional to the amount of Government securities under each maturity group held by the total public. These have been derived from the figures of the maturity distribution of Government securities

published by "The Reserve Bank of India Monthly Bulletin" from time to time under the heading "Pattern of Ownership of Government debt".

The ideal way of computing this rate of interest would be to compute a separate rate of interest for each industry according to the spectrum of securities they deal with. But non-availability of data on the structure of securities of each industry compelled us to adopt the above procedure.

2.9. Price Level: For our study we have used the index number of wholesale prices as published by the office of the Economic Adviser to the Government of India, Ministry of Finance.

2.10. Security Prices: The security index is taken from the Reserve Bank of India, Monthly Bulletins.

2.11. Rate of return on Physical Assets: We calculated this by dividing the gross profits by the value of gross fixed assets.

Other variables which we have used in our study such as expected changes in the general price level and security prices, relative factor price (c/w), monetary assets (MA), wealth-income ratio are derived accorindly by using the above mentioned variables.

As the total amount of data we have used in this study will run into hundreds of pages and moreover as the data on all the above mentioned variables for all the categories for all the years are available in printed form (see appendix II for sources of data), we have not reproduced them here.

Appendix I

List of Industries of Medium and Large Public Limited Companies for which Time-Series Data are Available

I. Agriculture and Allied Activities (AAA)

1. Tea plantations
2. Coffee and Rubber plantation

II. Mining and Quarrying (MQ)

3. Coal Mining

III. Processing and Manufacturing; Food,Stuffs, Textiles, Leather and Products thereof:
(Consumer Goods Sector) (CGI)

4. Grains and Pulbs
5. Edible vegetable and hydrogenated oils
6. Sugar
7. Tobacco
8. Cotton Textiles
9. Jute Textiles
10. Silk, Rayon and Woolen Textiles

IV. Processing and Manufacturing; Metals, Engineering, Chemicals and Products thereof:
(Capital and Industrial Intermediate Goods Sector) (CIGI)

Metals:

11. Iron and Steel
12. Aluminium
13. Non-Ferrous Metals.

Engineering:

14. Transport Equipment
15. Electrical Machinery, Apparatus, Appliances etc.
16. Machinery (other than transport and electrical)
17. Foundries and Engineering Workshops.
18. Ferrous/Non-Ferrous Metal Products.

Chemicals:

19. Basic Industrial Chemicals.
20. Medicines and Pharmeceutical Preparations
21. Other Chemical Products
22. Matches

V. Processing and Manufacture: Not elsewhere classified:
(Consumer Intermediate Goods Sector) (COIGI)

23. Mineral Oils
24. Cement
25. Pottery, China Clay and Earthen Ware
26. Rubber and Rubber Products
27. Paper and Paper Products

VI. Other Industries: (Tertiary or Services Sector)
(TSS)

28. Construction
29. Electricity Generation and Supply
30. Trading
31. Land and Estate
32. Shipping
33. Hotels, Restaurants and Eating Houses

Appendix II

I. Data Sources:

1. "Financial Statistics on Joint Stock Companies in India 1950-51 - 1962-63" published by the Reserve Bank of India, Bombay 1966.

2. The following issues of the "Reserve Bank of India Bulletin".
Sept. 1957, June, 1962, March 1965, Feb, April, July,67, Jan., Sept., 1968, Jan., March, April, Nov., Dec., 1971, Jan.-Dec.1972.

3. Report on Currency and Fiance published by the Reserve Bank of India, 1960-61 to 1968-69 and "Economic Survey 1970-71", Government of India.

CHAPTER III

A Theoretical Study of the Business Demand for Money

I. Introduction:

1.1. This chapter deals with the theoretical models of the business demand for money and their econometric specifications for empirical analysis. Altogether it gives a comprehensive account of eight models of business demand for money under different assumptions. The first 7 models assume that money is a financial asset whereas the last one regards money as a factor of production. Four of the models are well known, namely the classical, the Keynesian, the Baumol-Tobin transactions demand model and the Meltzers' wealth model. The other four models are developed by improving and combining these models on the basis of new assumptions and hypotheses. For example the seventh model which is named as the 'balance sheet approach' model is an adaptation of the Meltzers' cross-section model into a time-series model. The eighth model is the 'neo-classical production theory' model in which money is regarded as a productive input and the objective of the business firm is to minimise the cost of production subject to a production function. The fourth model is an alternative model which is developed along the lines suggested by Whalen (14) by combining the classical-Keynesian-Baumol-Tobin hypotheses.

1.2. This chapter will discuss the above mentioned theoretical models of business demand for money in the following sequence:

1. Classical model
2. Keynesian model
3. Baumol-Tobin transactions demand for money model
4. A combined classical-Keynesian-Baumol-Tobin model
5. Meltzers' wealth model
6. A simple modification of Meltzers' model
7. A balance-sheet approach model
8. A neo-classical production theory approach model

II. The Classical Model:

2.1. The classical quantity theory of money is as much applicable to the economy as a whole as to a particular sector or unit of it such as the individual or the business firm. In fact the founders of the theory used to reason in terms of individual units and then derive their conclusion for the economy as a whole. The classicals have argued that money has only one function to perform namely to act as the medium of exchange. By this they mean that money is just required for transactions purposes only; as a means of bridging the gap between the receipt of payments and the disbursements of such proceeds. It has no store of value function. Or in other words there is not any speculative demand for money. This theory rules out the the possibilities of influence of such factors as expectations regarding future prices (both commodity and

security prices), interest rates, market imperfections, risk and uncertainties, upon the demand for money. So according to them the demand for money solely rests upon the volume of transactions conducted and the pattern and nature of the income and expenditure streams which depend upon certain institutional factors such as system of payments, the number of stages of production, the frequency of receipts and disbursements in the economy and so on, which remain more or less constant during a short period of time and change only in the long run, if they change at all. So the demand for money varies proportionately with the volume of transactions. This is the so-called 'Quantity Theory Proportionality Rule or Law' of demand for money. We can express this relation in the following way symbolically. Given the price level, the institutional pattern of income-expenditure streams, the demand for money is

$$M = AY^a \qquad (1)$$

Where M is the nominal demand for money

Y is the nominal money income.

A is a constant and

a is the income elasticity of demand for money which the classicals assumed to be equal to unity.

2.2. The version that we have presented is only one version of a few that are available. One more prominent version is that of Marshall (see 35 ,p 44 and

also 36, p.166).who argued that the demand for money is influenced not only by the flow variable namely income, but also by the stock variable namely wealth.

2.3. Recently Professor Milton Friedman (7,p.51-67) has claimed to have restated the quantity theory. According to him what is necessary for the validity of the quantity theory is not the constancy of the velocity of circulation of money but that it should be "stable". In other words changes in velocity should be explained by changes in independent factors affecting it. But as Professor Patinkin has pointed out, Friedman's contribution is somewhat "mislabelled" because his restatement "is actually much closer to the Keynesian theory than to the quantity theory ... For whereas Keynesian theory emphasizes the optimal relationship among stocks of assets (which is Friedman's primary concern), neo-classical (and traditional Chicago) theory emphasized the optimal relationship between the stock of money and the flow of planned expenditures" (see 8,p.81-82).

III. Keynesian Model:

3.1. From the point of view of Keynesian approach, the business demand for money may arise due to three motives namely,

(a) The transactions motive,

(b) The investment or speculative motive,

(c) The precautionary motive

On the basis of these motives we can divide the total demand for money into two categories namely

(i) Transactions balances*

(ii) Investment balances

The purpose of dividing the total demand for money into these two categories is to clarify the distinction between the stock (store of value) and flow (medium of exchange) functions of money. This is what Keynes had in mind when he divided the total demand for money into M1 and M2. As he himself states "money held for each of these purposes, forms nevertheless, a single pool, which the holder is under no necessity to segregate into water-tight compartments; for they need not be sharply divided in his own mind, and the same sum can be held primarily for one purpose and secondarily for another. Thus we can equally well and perhaps, better-consider the individuals' aggregate demand for money in given circumstances as a single decision, though the composite result of a number of different motives" (37,p.195).

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* This includes also the Keynesian precautionary motive. Even though Keynes discussed this motive separately, in the money demand function he regarded the demand for money that arises due to transaction and precautionary motives as a single quantity depending upon the volume of transactions or current income (see 37, p.197).

3.2. Transactions Balances: No economic unit-firm or household or Government - enjoys perfect synchronization between the pattern of its receipts and disbursements. The discrepencies necessitate the holding of cash balances which accumulate temporarily, and are used up later in the year when expenditures catch up. Given the income a business firms' demand for such cash balances will depend upon the institutional arrangements that determine the degree of synchronization between individual receipts and expenditures. Given these institutional arrangements, the demand for such cash balances will vary proportionately with the volume of transactions. These cash balances are called as M1 by Keynes.

3.3. Investment or Speculative Demand for Money: This demand for money arises from speculative motive on the part of the economic units. It is primarily due to the fact that money is not only a medium of exchange, but also a store of value. According to Keynes this demand for money is inversely related to the rate of interest.

3.4. Reasons for Holding Money as an Asset:

(a) One important reason why people demand money, a non-earning asset in preference to earning assets is the future value certainty of money in contrast to the uncertainty in the future values of other assets like securities. Being traded on free markets, the ... prices of securities are subject to fluctuations in

either direction so that the possibility of incurring some loss can not be ruled out. Hence if an individual expects security prices to fall in future by an amount large enough to wipe out or more than wipe out the interest earned during the period, then he will find it more advantageous to hold his asset in the form of money. He may cease to hold money for speculative purposes only in the special case when he expects with perfect certainty that there will be absolutely no fall in security prices below the critical level in future. Expectations are, however, seldom held with such a high degree of certainty. There is often a penumbra of doubt surrounding each expectation so that one is confronted with a set of probabilities and is not even certain with regard to these probability distributions. Uncertainty increases the demand for money by increasing the fear of loss on other assets. It may be said that uncertainty also suggests the probabilities of gain. But it is well known that the effect of a fear of loss is more important than that of an equal hope of gain so that it is preferable to hold money even where the possibility of a falling security prices is rated as equal to that of a price rise. Thus risks, uncertainties and expectations give rise to the speculative demand for money.

(b) Another reason for preference of money is the cost or trouble associated with the acquisition of any other asset. Money is the only asset whose acquisition

does not involve any cost. In contrast transactions in other assets like securities involve expenses on brokerage and stamp duty. As Hicks has pointed out "a person is debarred from investing money for short periods partly because of brokerage charges and stamp duties, partly because it is not worth the bother ... The net advantage to be derived from investing a given quantity of money consist of the interest or profit earned less the cost of investment. It is only if this net advantage is expected to be positive (i.e. if the expected rate of interest ± capital appreciation or depreciation is greater than costs of investment) that it will pay to undertake the investment (ref.38,p.6).

(c) Yet another reason why money is demanded as an asset is provided by market imperfections. "If an investor is to adjust his portfolio continually to change in his market expectations, he must do so promptly, lest the opportunity of gaining from the market movement may be lost. But prompt adjustment requires a high degree of marketability or saleability of the assets held. In an imperfect market this is not likely to exist: the rate at which one asset can be exchanged for another will be more favorable if more time is taken to shop round than if a rush sale is made, but the time taken to shop round may be costly. In the case of money marketability is perfect, so that a satisfactory exchange of money into goods or bonds may be accomplished more promptly than exchanges

between non-money assets ... marketability, to be sure, would have little or no importance if money would always be obtained at going market rate of interest, But such an assumption is unrealistic. Imperfections in the credit market (i.e., the existence of credit rationing) must be reckoned with. Consequently marketability considerations weigh heavily in the demand for asset money, the more so the less predictable are the future developments in the asset market" (39,p.227-28).

Thus the attributes of money with respect to cost, marketability and money-value certainty lead individuals to keep it as an asset.

3.5. The Relation between the Speculative Demand for Money and the Rate of Interest:

Keynes has pointed out that this speculative demand for money is inversely related to the rate of interest, and thereby deduced his famous liquidity preference curve. He suggests a number of theoretical explanations for this. But as Mr. Kaldor (40) and Professor Tobin (21) have pointed out, the explanation to which he gave the greatest emphasis is the inealsticity of interest expectations associated with the notion of a 'normal' long term rate, to which the investors expect the rate of interest to return. When he refers to uncertainty in the market, he appears to mean disagreement among investors concerning the future of the rate rather than subjective doubt in

the mind of an individual investor. Keynes showed that at rate of interest lower than the normal rate, people would expect a rise in the rate or a fall in bond prices in the future. But it has already been shown that the greater the expectation of a fall in security prices, the stronger the reason for holding more money and vice versa.

It should be noted in this context that the Keynesian analysis in so far as it runs in terms of expectations of future interest rates is neither necessary nor sufficient for an explanation of the liquidity preference curve. A more important factor is the certainty with which expectations are held. If expectations regarding the future of the rate of interest were held with certainty, then as Professor Tobin has pointed out, the relationship between asset money and the rate of interest would be a discontinuous function rather than the familiar liquidity preference curve (21,p.68). If the current rate is above the critical level then an individual will put everything in cash. However, even then, it is possible to derive the liquidity preference curves for the economy or sector or industry as a whole by assuming that different units have different estimates of critical rates in their mind. "Strictly speaking the curve is a step function, but if the number of investors is large it can be approximated by a smooth curve." (ibid., p.69).

Once we introduce risks and uncertainties as factors affecting the demand for money and assume that asset-owners dislike risks (i.e. risk aversors) then as Professor Tobin has very well pointed out, the asset demand for money will be interest-elastic because asset-owners have to weigh the riskiness of their assets against their yields. Professor Tobin has shown that this theory does not depend on the inelasticity of expectations of future interest rates but can proceed from the assumption that the expected value of capital gain or loss from holding interest bearing assets is always zero. In other words, it is no longer necessary to assume that investors assign different risk factors to the money value of securities at different rates of interest. Risk of loss may be the same whether the rate of interest is high or low. But the higher the rate of interest the more the important is the yield as compared to the risk and the less the money held as an asset; and the lower the rate the more the importance of the risk as compared to the yield and the greater the amount of money to be kept as an asset. There will be an inverse relation between the rate of interest and idle money so long as risks and uncertainties are involved.

3.6. Total Demand for Money: Combining the above discussed two categories of demand for money, Keynes (37, p.199-200) derived the total demand for money as follows:

$$M = M1 + M2 = L_1 (Y) + L_2 (r) \qquad (3.3.1)$$

Where Y is the current income

r is the rate of interest

M1 is the transactions demand for money

M2 is the speculative demand for money

M is the total demand for money

Even though Keynes himself has represented the total demand for money in those terms, it conflicts with the argument that he gives about the relation between the rate of interest and idle money in the very next page. He says

> "uncertainty as to the future course of the rate of interest is the sole intelligible explanation of the type of liquidity-preference L2 which leads to the holding of cash M2. It follows that a given M2 will not have a definite quantitative relation to a given rate of interest r, what matters is not the absolute level of r but the degree of its divergence from what is considered a fairly safe level of r, having regard to those calculations of probability which are being relied upon" (Keynes 37, p.201).

If we accept this formulation as the right Keynes' version then we can derive the total demand for money as follows:

$$M = M1 + M2 = L1 (Y) + L2 (r-r_e)$$

where r_e refers to the expected normal rate of interest. Unfortunately there is no way of finding out empirically this expected normal rate of interest. Our purpose here is to point out the existence of such a formulation in Keynes book.

IV. Baumol-Tobin Model of Transactions Demand for Money:

4.1. The two famous papers dealing with the transactions demand for money under rational economic behavior are those of Baumol (15) and Tobin (20). Both of them arrive at identical hypotheses or conclusions such as:

(i) There are economies of scale in the transactions demand for cash in the sense that the transactions demand for cash increases less than in proportion to the volume of transactions and

(ii) Changes in the rate of interest call forth switching between cash and bonds (or securities).

Tobin himself admits "The model used in the paper is much the same as that used by Baumol, and the maximization of my expression gives essentially the same result as Baumols' equation" (see 20).

So we will first explain the transactions demand for money model in terms of Baumols' inventory theoretic approach and then subsequently point out in what way way Tobins' model differs from that of Baumols' even though both of them arrive at identical conclusions.

4.2. Baumols' Inventory Theoretic Approach: By applying the methodology of inventory theory to the theory of demand for money, Professor Baumol arrived at a new conclusion that the transactions demand for cash

varies with the square root of the value of transactions rather than in proportion with it as usually held.

The above conclusion follows from the assumptions that he made. Broadly speaking there are 3 ways in which people obtain cash for transactions purposes:

(i) by borrowing it or by withdrawing it from an investment

(ii) partly by withdrawing it from an investment and partly withholding it from cash receipts.and

(iii) by withholding cash receipts only.

By relying on the 3rd method the classicals and the Keynesians have derived their proportionality rule. Baumol relied on the first method in deriving his square root formula. Even though he was aware of the second method, he did not attach importance to it.

Model I:

To abstract from speculative and precautionary demands, he assumed that transactions are perfectly foreseen and occur in steady stream. Suppose that in the course of a given period an individual will pay out T rupees in a steady stream. He obtains cash either by borrowing it or by withdrawing it from an investment and in either case his interest cost (or interest opportunity cost) is i rupees per rupee per period.

Suppose finally that he withdraws cash in lots of C rupees spaced evenly throughout the period, and that each time he makes a withdrawal he must pay a "fixed" brokers' fee of 'b' rupees. Here T, the value of transactions is predetermined and i and b are assumed to be constant. Now over the course of the year he will make T/C withdrawals, at a total cost in brokers' fee given by bT/C.

Since in this case each time he withdraws C rupees he spends it in a steady stream and draws out a similar amount the moment it is gone, his average cash holding will be C/2 rupees. His annual interest cost of holding such cash will then be iC/2.

Thus the total cost involved in the transaction demand for money is given by the sum of interest cost and'brokers' fee which is given by

$$bT/C + \frac{iC}{2} \qquad (3.4.1)$$

Economic rationality on the part of the consumer requires that he minimizes this cost. To achieve this let us differentiate this function with respect to C and set it equal to zero. We obtain

$$-\frac{bT}{C^2} + \frac{i}{2} = 0$$

$$\text{(i.e)} \quad C = \sqrt{\frac{2bT}{i}} \qquad (3.4.2)$$

This result is unchanged even if there is a part of the

brokers' fee which varies in proportion with the quantity of cash handled. For in this case brokers' fee for each loan is given by b + kC. Total cost in brokers' fee will then be

$$T/C\ (b+kC) = \frac{T}{C}\ b + kT$$

Thus (3.4.1) will have a constant term, kT, added to it which drops out in differentiation. Thus in the simple model Baumol has set, the rational individual, given the price level, demands cash in proportion to the square root of the value of his transactions.

Baumol in this context notes "this crude model ... as it stands, applied to two sorts of cases: that of thee individual (or firm) obtaining cash from his invested capital and that of the individual (or firm) spending out of borrowing in anticipation of future receipts (see 15).

Model II:

The implication of the second case has also been subsequently analysed by Professor Baumol and he concludes that it does not affect the general nature of the result derived earlier (i.e.) the square root solution. But this can be questioned.

According to the second method, part of the cash requirement is met from cash receipts and part from withdrawals from investment. An individual receiving cash

withholds some of his receipts from investment and keep them in cash until they are used for transactions purposes. Baumol denotes them by R. Once his withheld cash is used up, the individual starts withdrawing cash as before in "lots of C rupees" from his investment until his next cash receipt occurs. Now the average demand for cash becomes equal to

$$\frac{\frac{R}{2} t_1 + \frac{C}{2} t_2}{t_1 + t_2} \qquad (3.4.3)$$

Where t_1 is the fraction of the "receipt period" for which R is withheld from investment and t_2 is the remaining fraction of the "receipt period". But as Baumol has pointed out R is equal to

$$C + T\left(\frac{K_w + K_d}{i}\right) \qquad (3.4.4)$$

Where K_w and K_d are the marginal brokerage cost of withdrawing and investing respectively and C varies with the square root of T in the manner specified earlier. According to equation (3.4.3) average cash balance is equal to

$$R\left(\frac{t_1}{2t_1 + 2t_2}\right) + C \left(\frac{t_2}{2t_1 + 2t_2}\right) -$$

$$= \left(C+T \frac{K_w+K_d}{i}\right) \left(\frac{t_1}{2t_1+2t_2}\right) + C \left(\frac{t_2}{2t_1+2t_2}\right)$$

by substituting the value of R from equation above. Now by substituting for C and simplifying we get

$$= \sqrt{\frac{bT}{2i}} + T/2 \left(\frac{K_w+K_d}{i}\right) \left(\frac{t_1}{t_1+t_2}\right) \qquad (3.4.5)$$

Thus the demand for cash comes to be determined by two terms one of which varies as the square root of T and the other in proportion with it. This is in contrast to the strictly square root formula of Baumols' model I.

4.3. Tobin: (i) Tobins' analysis leads to the same conclusion as Baumols' even though Baumol is mainly interested in the implications of his analyis for the theory of the transactions velocity of money at a given rate of interest, while the focus of Tobins' paper is on the interest elasticity of the demand for cash at a given volume of transactions. There are also other differences between Baumols' and Tobins' analysis such as

(i) Tobin permits the number of transactions to take on only positive integral values while Baumol treats the corresponding variable as continuous.

(ii) Tobins' paper proves what Baumol assumes, namely that cash withdrawals should be equally spaced in time and equal in size.

(iii) Also Baumol does not consider the possibility that, in the general case where the individual has both receipts and expenditures, the optimal initial investment is zero. Of the four kinds of solutions that Tobin gives, Baumol considers only one. In part this is because he treats the decision variable as continuous and looks only for the regular extremum. But it is also because

of this definition of the problem. Baumols' individual instead of maximizing his earnings of interest net of transactions costs minimizes a cost which includes an interest charge in his average cash balance. This definition of the problem leads Baumol to overlook the question whether interest earnings are high enough to justify any investment at all.

In addition to the square root solution to the business demand for money, Tobin analysis also puts forward two more testable hypotheses (Tobin (22), p.236-37) namely

(i) the ratio of cash to total transactions balances (i.e. the ratio of M to MA) is not independent of the volume of transactions.

(ii) the ratio of cash holdings to (the volume of transactions) Y will vary inversely with (the volume of transactions) Y.

V. A Combined Keynes - Baumol-Tobin Approach:

5.1. Integrating the ideas of Whalen (14), Keynes and Baumol we can develop a model which will be useful for a cross-section study of business firms. In an earlier section we have seen that Keynes divided the total demand for money into two categories namely M1 and M2. The M1 comprises of the demand for cash balances that arises due to transactions and precautionary motives. M2 refers to the quantity of money demanded (as an asset) for speculative

or investment purposes. Thus the total demand for money is

$$M = M1 + M2 \qquad (3.5.1)$$

Keynes also held the view that the transactions demand for money is proportional to the volume of transactions which for a business enterprise may be represented by sales. So that

$$M1 = b_1 S \qquad (3.5.2)$$

According to Baumol-Tobin version the demand for money in the modified statement is parabolic (i.e.)

$$M1 = b_1 S + C_1 \sqrt{S} \qquad (3.5.3)$$

5.2. Demand for Money held for Speculative Purposes: A relevant framework of analysis is provided by Tobins' (Ref.21) application of portfolio theory to liquidity preference. In his study he first introduces the concept of an investment portfolio balance, defined as those assets of a firm which consist of cash held for investment purposes and income-earning assets "that differ from cash only in having a variable market yield" (21). Then he demonstrates that the proportion of a firms' investment portfolio balance held in the form of cash depends on the rate of return on the alternative income-earning assets, the degree of risks associated with holding these assets and a firm's preference between return and risk. This proportion - the ratio of cash held for investment

purposes to investment portfolio balances - is assumed to be independent of the size of the portfolio balances. That is, given the rate of return on alternative income-earning monetary assets, the degree of risk associated with holding these assets, and preferences between return and risk, the proportion of investment portfolio balances held in the form of cash is constant.

If a_1 represents the proportion of investment portfolio balances held in the form of cash, then by definition

$$a_1 = M2/I \qquad (3.5.4)$$

Where I stands for the amount of investment portfolio balances. When this equation is solved for cash held for investment purposes it is seen that

$$M2 = a_1 I \qquad (3.5.5)$$

Stated in this form the equation for the investment demand for cash is not operationl $(M2)_2$ because the balance sheet data provided by firms do not contain any information on M2 and/or I. Therefore, an alternative expression for investment portfolio balances must be obtained.

In a firm's balance sheet there are two types of monetary assets

(i) Cash balances

(ii) Income-earning monetary assets, which are close substitutes for cash.

If we let M stand for cash balances, B for income-earning assets - hereafter referred to as securities - and MA for total monetary assets then

$$MA = M + B \qquad (3.5.6)$$

From the stand point of economic theory, however, total monetary assets can be divided into two different parts:

(i) Transactions balances (T) and

(ii) Investment balances (I)

$$MA = T + I \qquad (3.5.7)$$

Transactions balances are those balances resulting from lack of synchronization between a firm's receipts and disbursements. If firms manage these balances according to the principles suggested by the Baumol-Tobin analysis, they - like investment portfolio balances - consist of cash and securities. Otherwise - that is, if they follow the traditional monetary theory principle - transaction balances will consist of cash only. As is pointed out by Tobin (Ref.120) although a firm may have discretion over bond-and-cash composition of its transactions balances the amount of its transactions balances is determined by its pattern of receipts and disbursements, a factor which is generally considered to be outside the scope of a firm's control. When a firm's pattern of receipts and disbursements is constant transactions balances vary proportionately with the volume of its sales so that

$$T = k.S \qquad (3.5.8)$$

Where k is a constant equal to or greater than zero and less than or equal to one. The expression k.S provides a proxy variable for transactions balances. When it is substituted for T in equation the equation becomes

$$MA = k.S + I \qquad (3.5.9)$$

solving the above equation for I

$$I = MA - k.S \qquad (3.5.10)$$

and substituting this expression for investment portfolio balances into equation (35.5) produces the following equation for cash held for investment purposes.

$$M2 = a_1 (MA - k.S) \qquad (3.5.11)$$

The above equation meets the condition that the independent variables be defined in measurable terms.

5.3. Demand for Cash Equation: Now the equations both for the transactions demand for cash and the investment demand for cash have been established, an equation for the total demand for cash can be determined. The equation for the total demand for cash has two alternative forms, one which represents the proportionate relationships between transactions cash balances and sales implied by the traditional monetary theory and the other which represents the less than proportionate relationship suggested by the Baumol-Tobin approach. The demand for cash equation

representing the relationship implied by traditional monetary theory is obtained by substituting into equation (3.5.1) the expression for M1 and M2 found in equation

$$M = b.S + a_1 (MA - k.S) \qquad (3.5.12)$$

To obtain the demand for cash equation representing the relationship suggested by the Baumol-Tobin analysis, the expressions for M1 and M2 found in equations (3.5.2 & 3.5.11 are substituted in equation

$$M = b_1 S + C_1 \sqrt{S} + a_1 (MA - k.S) \qquad (3.5.13)$$

These equations can further be simplified as follows:

$$M = a_1 MA + (b - a_1.k) S$$

$$M = a_1 MA + (b_1 - a_1.k) S + C_1 \sqrt{S}$$

Which can further be simplified into

$$M = a_1 MA + b_1 S \qquad (3.5.14)$$

$$M = a_2 MA + b_2.S + C_1 \sqrt{S} \qquad (3.5.15)$$

VI. Meltzers' Wealth Model:

6.1. Alan Meltzer through a couple of articles (2,3) has propounded a new theory of demand for money which has now come to be popularly called as wealth model. According to Meltzer "if money is held as part of a portfolio of assets, the decision about the aggregate amount of money

to be held may be regarded as subject to a wealth constraint and dependent on the yields of a variety of alternative assets" (see 3, p.407). The arguments of the demand function for money are the variables r^* the yield on financial assets, P, the yield on physical assets, d^* the yield on human wealth, W_n non-human wealth. Let M represent the quantity of money (nominal) demanded. Then

$$M = f\ (r^*,\ P,\ d^*,\ W_n)$$

is a general demand function for money.

W_n represents the constraint which wealth imposes on the demand for money. r^*, P, and d^* measure the yields of assets other than money that compete for a place in the balance sheet of the firm. The derivative of these yields with respect to M is negative. If the demand function is homogenous of 1st degree in the money value of W_n

$$M = f^*\ (r^*,\ p,\ d^*, 1)\ W_n$$

Let $d^* = \frac{Y_h}{W_h}$ the ratio of human income to human wealth.

Multiphy d^* by $\frac{Y^*_h}{Y^*_h}$ $(=1)$

Where Y^*_h is the stream of income expected from a stock of human wealth.

$$M = f^*\ (r^*, p, \frac{Y_h}{Y^*_h} \cdot \frac{Y^*_h}{W_h},\ 1)\ W_n$$

The yield on human wealth is now viewed as the product of two components. The first term measures the short-run deviations of actual from expected human income; it is an index of the transitory component of the human income. Let this index be denoted by B. In the short-run wealth owners may adjust their composition of their portfolios in response to changes in , but will equal 1 in the long run. The second term in d^*, Y^*_h/W_h is the ratio of human income expected to its capitalised value. This can be taken as a constant d. Finally he combines r^* and p in the rate of interest r. The extent to which the rates r^* and p can be measured by a single number, r, depends on the covariance of these two rates. In the long run we can expect that asset adjustments will lead to high covariance between there rates.

With these assumptions and the subscript n dropped from W_n the equation becomes

$$M = g(r)\, W \qquad (3.6.1)$$

Note that as a result of the assumption that the equation is homogenous in W_n, the non-human wealth variable appears as a multiplicative factor in the function with coefficient of 1.

In its present form the above equation reflects the wealth constraint and substitution effect on the demand for money. That is, the equation reflects the general view

that the demand function for money is part of the general theory of portfolio composition or asset choice.

6.2. The distinguishing feature of the Meltzers' model is that in contrast to Friedman formulation where the human wealth appears as a constraint along with non-human wealth, the ratio, d is treated as a constant.

In empirical research the equation can be given a particular form say

$$M = k\, r^a\, W^b \qquad (3.6.2)$$

In order to maintain a given level of sales, at any time a firm must keep some stock of capital, level of inventory, investments in accounts receivable, cash balances etc; such that it can produce and deliver the requisite output, finance transactions, pay for its (past) purchases of material and labor, or in short operate its business. From this we are led to look at the sales of a firm as being equal to a stream of gross earnings related to a particular stock of and composition of assets.

Let W_{ij} be the non-human assets invested in the i^{th} firm of the j^{th} industry: let S_{ij} be the sales or gross income of the firm and p_j be the internal rate of return on assets for an industry or class of firms. We may then write

$$S_{ij} = p_j\, W_{ij} \qquad (3.6.3)$$

However for this to hold strictly, we must first assume that the ratio of capital/labour is constant and second that either firms use all of their assets all of the time or redefine 'W' as the assets in use. Instead we can also write

$$S_{ij} = K_{ij}\, p_j\, W_{ij} \qquad (3.6.4)$$

Where K varies over the cycle with changes in demand for the firm's output and changes in the capital/labour ratio

Substituting (3.6.3) into (3.6.2) and letting M_{ij} be the cash balance of a particular firm gives

$$M_{ij} = \frac{kr^a}{(K_{ij}\, p_j)^b}\, S^b_{ij} \qquad (3.6.5)$$

Thus in the absence of changes in the interest rates, both internal and external, a firm's money balance should increase in relation to its sales. But 'a' is expected to be negative. A rise in market rates which accompanies an increase in sales will result in a less than proportional increase in cash balances. Similarly an increase in the internal rate of return on the proportion of assets used in production, K, will decrease cash balances relative to sales.

In general increases in demand or rising sales for the economy as a whole are accompanied by an increase in interest rates and greater utilisation of assets. The

above equation therefore suggests that velocity will increase in prosperity and fall in depression similar to those obtained by Baumol, Tobin and Friedman.

Relative shifts in demand or changes in product mix for the economy or the industry may lead to a decrease in velocity for particular firms depite a rise in the external rate of interest or a slight increase in sales. Thus it suggests that distribution may play an important role in the magnitude and timing of changes in aggregate velocity.

In short (3.6.5) equation denies that there is a simple relationship between business cash balances and their sales or income over time. First K will change over time. Second both external and internal rates of interest must be considered in a time series analysis. The absence of information for the short-run on p and K makes Meltzer assume that they are constant and using cross-section data find out the role of W. So we can write for cross-section purposes

$$M_{ij} = V_{ij} \quad S^{b}_{ij} \qquad (3.6.6)$$

Further he postulates the value of b equal to unity i.e., there are no economies of scale in the demand for cash balances with respect to wealth.

VII. A Simple Modification of Meltzers' Model:

By assuming r, K_{ij} and p_j as constants, Meltzer

has simplified the equation

$$M_{ij} = \frac{k.\, r^{a}}{(K_{ij}\ p_j)^{b}}\ S_{ij}^{b} \qquad \text{as}$$

$$M_{ij} = V_{ij}\ S_{ij}^{b}$$

These assumptions are questionable. For example the rates of interest for different firms or industries can be different depending upon what type of securities they deal with. Moreover, interest rates on monetary assets are not the only thing relevant for cash-management decisions. Interest rates on liabilities also affect this decision, since a firm may alter its cash balances not only by asset switching but also by borrowing or debt retirement. The cost of borrowing is generally held to be lower for large firms than for small ones, so neglect of changes in this variable may produce an upward bias in the coefficient relating to cash sales. Similarly there is no assurance that the capital/labour ratio or the internal rate of return on assets is identical for different firms in the same industry. For example, higher costs of external financing may require small firms to be more labor-intensive. By solving the equation

$$S_{ij} = K_{ij}\ p_j.\ W_{ij} \quad \text{for} \quad p_j\ K_{ij}$$

We get

$$p_j K_{ij} = S_{ij}/W_{ij}$$

Now substitute this expression in the equation

$$M_{ij} = \frac{k.\ r^{a}}{(K_{ij}\ p_j)^{b}}\ S_{ij}^{b}$$

We get

$$M_{ij} = k.\ r^{a}\ (W_{ij}/S_{ij})^{b}.\ S_{ij}^{b}$$

As empirically there is no way of finding the inter industry differences in r we assume r is constant. The above equation becomes.

$$M_{ij} = a_{ij}.\ (W_{ij}/S_{ij})^{b}.\ S_{ij}^{C} \qquad (3.7.1)$$

By allowing for changes not only in sales but also in the wealth/sales ratio (W_{ij}/S_{ij}) this formulation of demand function attempts to recognise the combined effects of the transactions and the investment demand for cash on total cash holdings.

VIII. Balance Sheet Approach to the Business Demand for Money:

8.1. This model that we propose here is another extension of the Meltzerian wealth model. In order to suit the data that was available to Meltzer, he made a number of approximations and assumptions in his model both in his time series and cross-section analyses and finally expressed the time series demand for money as a function of wealth and rate of interest alone. He did not analyse the effect

of expectations regarding the price level changes on the demand for money. Thus in the time series analysis it is important to consider the effect of changes in the price level, changes in the expected future prices, changes in the rate of return on physical assets, changes in the rate of return on financial assets and changes in the volume of wealth upon the demand for money.

8.2. In order to accomplish our above mentioned objective it is hypothesized that subject to a wealth constraint an individual is supposed to adjust the composition of his balance sheet in response to changes in relative prices including interest rates, in order to obtain the balance sheet position that he prefers. Money like any other asset is a store of value. Two characteristics of money, as we have already noticed distinguish it from other assets namely, its higher liquidity and money value certainty enabling it to be a hedge against changes in prices.

Money helps indirectly in a number of ways in bringing about efficiency in production process; under equilibrium conditions the marginal net productivity of a rupee held in money would be equal to the marginal net productivity of a rupee held in any other asset. The greater the expected outlays and the expected receipts per rupee of a firm's wealth, and the greater the lack of synchronization between their time structures the more

money intensive is the production process and presumably the greater is the ratio of cash balances to wealth.

The demand for money to hold by a firm can be shown as follows:

$$M = f(W, r_b, r_e, p, dp/dt) \qquad (3.8.1)$$

Where M = nominal quantity of money

W = nominal wealth,

r_b = rate of return on financial assets

r_e = rate of return on physical assets

p = general price level

dp/dt = expected changes in the general price level.

The demand for money is directly related to the quantum of wealth (or income) and general price level, and inversely related to the rate of return on physical assets, the rate of return on financial assets and expected changes in the general price level.

IX. A Neo-classical Production Theory Approach:

9.1. This approach is based on the theoretical ideas of James Tobin (22), M. Sidrauski (41), Patinkin (8) and Nadiri (24). In this section we have made only an attempt to empirically specify the model for the purpose of testing its relevance and validity in the context of Indian business sector demand for money.

The models that we have discussed so far consider money as a financial resource whereas it has also been regarded as a factor of production by some economists. The basis for this kind of a productivity approach to money is the notion that money is desired and held, not for its own sake but as an intermediate good, for the services it can provide. The fact that money balances are actually held at positive (opportunity) cost may be taken to imply that they provide some return, or real income, sufficient to compensate for that cost. Such an interpretation seems to have its most natural application in the case of business enterprises. It is evident that in so far as they facilitate increased specialization and efficiency of resource allocation, the real money balances of firms contribute to the production and distribution of commodity in the same way as the physical factors labor and capital; and that therefore these balances should enter with the other factors into the firm's production function. From this point of view, the demand for real money balances, like the demand for other factors of production, derives purely from cost minimizing considerations subject to a production function in the business sector. Thus the real money balances are considered to be a function of the level of output, relative factor prices and the opportunity cost of holding money. By specifying and accurately measuring the opportunity cost of money, the factor prices and scale variables, it is possible to trace the influences

of capital gains, interest rates, factor prices, changes in the general price level and the size of transactions on the desired real cash holdings of the corporate sector.

9.2. The Specifications of the Model:

(a) The opportunity cost of money (v): The opportunity cost of money has three components:

(i) an interest cost

(ii) capital gains (losses) in the securities market-

and (iii) a depreciation cost

The first element is the interest income forgone by holding cash rather than short-term securities. The capital gains component is generally due to an anticipated rise in the price of security. The third element is a reduction in the purchasing power of money due an expected increse in the general price level. We can express this opportunity cost of money as

$$v = (r + P'_s/P_s + P'/P) \qquad (3.9.1)$$

Where v = opportunity cost of money

r = interest rate on securities

P'_s = expected change in the price of securities

P_s = price of securities

P' = expected change in the general price level

P = the general price level

(b) Cost of Labor: Labor is quasi-fixed factor of production and its user cost consists of a variable component and fixed charges. The variable component consists of the straight-time wage payments; the fixed costs are investment in training, skills, conditions of work etc. and a "depreciation cost" due to separation of the firm's labor force. The appropriate and ideal measure of user cost of labor would be to define the total wage bill as comprising of both the fixed and variable compoents. But due to non-availability of data on the fixed component, we will define our total wage bill as the total of salaries, wages and bonus paid to the workers. Thus

$$W = w_1 N \qquad (3.9.2)$$

Where W = Total wage bill

w_1 = wage rate per employee

N = total number of employees

(c) User-Cost of Capital: The ideal or appropriate way of defining user cost of capital would be

$$C = q/(1-u)\left[d+d_0 + d_1 s - q'/q\right] \qquad (3.9.3)$$

Where C = user cost of capital

q = the price of capital goods

q' = change in the price of capital goods as a measure of capital gains

d = the opportunity cost of capital

d_0 = the rate of depreciation due to passage of time

d_1 = the rate of depreciation due to intensive use of capital

s = the rate of utilisation of capital

u = the rate of corporate tax

Due to non-availability of data on s, d_0, d_1, u and individual industry data on the changes of price of capital goods, we have defined the user cost of capital services as the sum of cost of capital* and the depreciation cost as defined in chapter II.

The objective of the firm is to minimize the cost of production subject to a twice differentiable production function of the neo-classical type (i.e.)

Minimize $C = wL + cK + vm$ (3.9.4)

subject to $X^* = F(L,K,m)$

Where C = Total cost

K = Capital stock services

m = stock of real cash balances (M/P).

and X^* = Expected level of output

Minimizing (3.9.4) subject to the production function suggests that the demand function for real cash balances is

$$m^* = f(c/w, v, X^*) \qquad (3.9.5)$$

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* The cost of capital, for want of data, is obtained by multiplying the gross fixed capital by the opportunity cost which is the profit rate that is generally prevailing in the economy as a whole. This profit rate is derived by dividing the total gross profit of the business sector by the gross fixed capital of the buesnss sector.

derive this kind of an input demand function for money, it is highly doubtful whether this will have any empirical validity because of the unrealistic assumptions upon which the model is based. We would like to test this against our data.

X. Econometric Specification of Business Money Demand Functions for Empirical Testing:

10.1. Cross-section Specification: From the above discussion of the theoretical models of business demand for money, the following conflicting and competing hypotheses emerge.

(i) According to the classical theory of demand for money, the relevant constraint in the demand function for money is the flow variable namely current income and that the demand for money with respect to the level of current income is proportional to it. In other words the income elasticity of demand for money is unitary.

According to the Marshallian version of the classical theory, in addition to the flow variable namely current income, the stock variable namely wealth also imposes a constraint upon the demand for money.

The above two hypotheses can be represented by the following two regression equations

$$\log M = \log A_1 + a_1 \log Y \qquad (3.10.1)$$

Which is derived from the equation

$M = A_1 Y^{a_1}$ where a_1 is hypothesized to be equal to

one and M refers to the nominal quantity of money and Y nominal money income.

$$\log M = \log A_2 + a_2 \log Y + b_2 \log W \qquad (3.10.2)$$

Which is derived by giving the Marshallian function a multiplicative form as

$$M = A_2 Y^{a_2} W^{b_2}$$

(ii) According to Baumol-Tobin transactions theory of demand for money, the demand for money will increase less than proportionately with the volume of transactions. And in the special case of Baumols' square root solution the income elasticity of demand for money is equal to one half (i.e) .5. This hypothesis can be tested with the help of the same regression equation as (3.10.1) because the logrithmic derivation of the Baumol square root solution gives the same regression equation as (3.10.1). But here it is hypothesized that the value of $a_1 = .5$.

(iii) According to Allan H. Meltzer the relevant constraint in the demand function for money is wealth and the demand for money is proportional to wealth. In other words the elasticity of demand for money with respect to wealth is unitary. This can be expressed in regression equation as follows:

$$\log M = \log A_3 + a_3 \log W \qquad (3.10.3)$$

Which is derived from the multiplicative relation

$$M = A_3 W^{a_3}$$

Where a_3 is hypothesized to be equal to one.

(iv) According to the modified version of Meltzers' wealth model the demand for money not only depends on wealth which is measured in the regression equation by income, but also by the ratio of wealth to income. The regression equation to test this hypothesis will be

$$\log M = \log A_4 + a_4 \log Y + b_4 \log (W/Y) \qquad (3.10.4)$$

Which is derived from the multiplicative relation hypothesized namely $M = A_4 Y^{a_4} (W/Y)^{b_4}$

(v) According to the two different specifications of the combined Keynes-Baumol-Tobin approach the demand for money is influenced by the quantum of monetary assets and income. If we estimate equation (3.5.14) and (3.5.15) directly, then we will face dominant variable problem and multi-collinearity problem because the correlations between money and monetary assets; and monetary assets and income are very high. And also as our regression equationsare linear the extremum values from the use of absolute magnitudes would bias our regression results. In order to avoid these problems, using monetary assets as a size deflator, we have divided the above expressions by monteary assets (MA). Now those two equations can be written as

$$M/MA = A_5 + a_5 \sqrt{Y/MA} \qquad (3.10.5)$$

$$M/MA = A_6 + a_6 \sqrt{Y/MA} + b_6 Y/MA \qquad (3.10.6)$$

(vi) The two additional hypotheses put forward by Tobin (20, p.236-37) can be tested by the following two regressions equations:

$$M/MA = A_7 + a_7 Y \qquad (3.10.7)$$

$$M/Y = A_8 + a_8 Y \qquad (3.10.8)$$

Thus we have 8 cross-section regression equations representing different hypotheses conserning the business demand for money:

$$\log M = \log A_1 + a_1 \log Y \qquad (CS1)$$

$$\log M = \log A_2 + a_2 \log W \qquad (CS2)$$

$$\log M = \log A_3 + a_3 \log Y + b_3 \log W \qquad (CS3)$$

$$\log M = \log A_4 + a_4 \log Y + b_4 \log (W/Y) \qquad (CS4)$$

$$M/MA = A_5 + a_5 \sqrt{Y/MA} \qquad (CS5)$$

$$M/MA = A_6 + a_6 (\sqrt{Y/MA}) + b_6 (Y/MA) \qquad (CS6)$$

$$M/MA = A_7 + a_7 Y \qquad (CS7)$$

$$M/Y = A_8 + a_8 Y \qquad (CS8)$$

10.1. Time-Series Specification: On the basis of the models that we have discussed from section II to IX in this chapter, we can specify six time series business money demand functions as follows:

(i) $M = A_1 Y^{a_1} r^{b_1}$ (Baumol, Keynes & Meltzers' models)

(ii) $M = A_2 W^{a_2} r^{b_2}$ (Wealth model)

(iii) $M = A_3 Y^{a_3} W^{b_3} r^{c_3}$ (Marshallian model)

(iv) $M = A_4 Y^{a_4} (W/Y)^{b_4} r^{c_4}$ (Modified Meltzer model)

(v) $M = A_5 Y^{a_5} r^{b_5} P^{c_5} R^{d_5} (P'/P)^{e_5}$ (Balance sheet approach model)

(vi) $M/P = A_6 (Y/P)^{a_6} r^{b_6} (c/w)^{d_6} (P'/P)^{e_6} (P'_s/P_s)^{g_6}$ (Neo-classical production theory model)

The parameters a_i, b_i, c_i, d_i, e_i and g_6 represent the elasticity coefficient of money with respect to the explanatory variables Y, (Y/P), (W/Y), r, (P'/P), (P'_s/P_s), P, R and c/w which we have defined earlier.

For econometric estimation purposes the above equations can be converted into logrithmically linear equations as follows:

$$\log M = \log A_1 + a_1 \log Y + b_1 \log r \qquad \text{(TS1)}$$

$$\log M = \log A_2 + a_2 \log W + b_2 \log r \qquad \text{(TS2)}$$

$$\log M = \log A_3 + a_3 \log Y + b_3 \log W + c_3 \log r \qquad \text{(TS3)}$$

$$\log M = \log A_4 + a_4 \log Y + b_4 \log (W/Y) + c_4 \log r \qquad \text{(TS4)}$$

$$\log M = \log A_5 + a_5 \log Y + b_5 \log r + c_5 \log P + d_5 \log R + e_5 \log (P'/P) \qquad \text{(TS5)}$$

$$\log (M/P) = \log A_6 + a_6 \log (Y/P) + b_6 \log r + d_6 \log (c/w) + e_6 \log (P'/P) + g_6 \log (P'_s/P_s) \qquad \text{(TS6)}$$

All these regression equations are estimated by the familiar least squares method by making the well known

assumptions regarding the error term which we have not mentioned in the equations above but which are implicitly assumed there. Whenever we confronted with any econometric problems such as auto-correlation, multicollinearity etc. we used the familiar and generally accepted procedures as found in references 16 to 19, 31,32,34,and 42 to 44.

CHAPTER IV

Aggregate Analysis of Business Demand for Money in India

I. Introduction:

1.1. In this chapter we will be dealing with an aggregate analysis of business demand for money using both cross-section and time-series data. In this context we will make an attempt to evaluate the predictive or explanatory performance of different models of business demand for money which we have already discussed at length in the IIIrd chapter and thus find out the most relevant and adequate model of business demand for money for Indian business sector. The main hypoetheses that emerge out of these models have been summarised in chapter III and their econometric specification have also been worked out in the same chapter.

1.2. As our main objective is to evaluate the predictive or explanatory performance of these models of business demand for money, let us find out the criteria for evaluating the predictive performance of these models. The most commonly accepted measure of predictive performance of a model in applied econometric works has been the square of the multiple correlation coefficient or what is alternatively termed as the coefficient of determination or R^2. Where

$$R^2 = \frac{\text{Variation explained by the regression equation}}{\text{Total variation of the dependent variable}}$$

Since the residuals represent the movement in the dependent variable that is unexplained by the independent variables, the R^2 may also be expressed as

$$R^2 = \frac{\Sigma(Y-\bar{Y})^2 - \Sigma e^2}{\Sigma(Y - \bar{Y})^2}$$

Where $\Sigma(Y-Y)^2$ and Σe^2 are variations of the dependent variable and of the residulal respectively.

1.3. But for our purposes of evaluating the comparative predictive performance of models of business demand for money we will be using a slightly modified measure of R^2 which we can call it as $\bar{R}^2$. This modification is required because even though the dependent variable which different models of money deal with is the same, the number of independent variables that appear as arguments or causal factors in the business demand function for money are not identical for all models. Or to put in other words the number of parameters estimated in the business demand function for money are different for different models. So it becomes essential to take into account the degrees of freedom gained or lost due to an exclusion or inclusion of a variable in the estimation of parameters of models of business demand for money. So our modified R^2 is

$$\bar{R}^2 = 1 - V(e)/V(Y)$$

Where $V(Y)$ is the variance of Y defined as

$$V(Y) = \Sigma(Y-\bar{Y})^2/T-1$$

Where T = total number of observations and $V(e)$ is the

residual variance defined as $V(e) = \frac{\Sigma e^2}{v}$

Where Σe^2 is the residual sum of squares and v is the degrees of freedom (i.e., the total number of observations less the number of constraints imposed on the residuals in estimating the parameters). An equivalent expression is

$$\bar{R}^2 = 1 - (1-R^2)\ T-1/T-K$$

Where K = total number of parameters estimated including the constant term in the regression equation

So defined $\bar{R}^2$ can decrease when a new variable is added to a regression equation even though R^2 necessarily increases. Since V(Y) does not depend on the independent variables, there is one to one correspondence between the $\bar{R}^2$ and the variance of the residual V(e).

1.4. In addition to $\bar{R}^2$, we will also consider secondarily other econometric properties such as the appropriate algebraic signs for the estimated parameters, their statistical significance in terms of t values, the stability of the parameters over time and how far the estimated parameter is free from such econometric problems as multi-colinearity, dominant variable, auto-correlation etc.

1.5. This measure of ($\bar{R}^2$) predictive performance in addition to being used for evaluating different models for their relevance and importance in the Indian context, is being used for choosing the most appropriate empirical definition of money. We will choose that definition of

money which produces the highest $\bar{R}^2$. This is an accepted and most used procedure in empirical research. As Professor Milton Friedman has pointed out "The argument for this procedure is that the precise empirical definition of variables should be selected so as to put the theory in its best light" (see 7,p.181).

1.6. Here it should be noted that this measure of predictive performance ($\bar{R}^2$) can be (and is) used as a measure of predictive performance for comparison and evaluation of different models only under the condition that the dependent variable is the same for all models. $\bar{R}^2$ can not be used to evaluate the predictive performance of different models if the dependent variables are different transformation of a particular variable or altogether different variables (for a more elaborate treatment of this see Rao and Miller (31) and G.P.E. Box and D.R. Cox (32)).

II. Objectives and Methodology:

2.1. This chapter will be mainly concerned with the following aspects in the business demand for money.

(a) Empirically, what is the most preferable definition of money (M1 or M2)?

(b) What are the relevant variables in the business demand function for money?

(c) Are the elasticity coefficients of money stable over time or are there any structural 'breaks'?

(d) How do the cross-sectionally estimated parameters compare with time-series estimated parameters?

(e) Do size and the type of ownership of companies make any significant difference to the money demand functions of the business sector?

2.2. In carrying out the above stated objectives we will be dealing with five kinds of aggregates according to the nature of ownership of joint stock companies namely

(a) Public Limited Companies:

(i) Total of all public limited companies (ii+iii)

(ii) Total of all medium and large public limited companies

(iii) Total of all small public limited companies

(b) Private Limited Companies:

(iv) Medium and large private limited companies

(v) Government Companies

The reason for choosing these aggregates have already been explained in earlier chapter.

2.3. This chapter will deal with both cross-section and time-series analysis. But there are certain limitations which should be borne in mind.

(a) Cross-section analysis of 33 industries for 21 years from 1950-51 to 1970-71 will be carried out for medium and large public limited companies alone as cross-section industry wise data are not available for other aggregates.

(b) While the total number of observations used in the time-series analysis of medium and large public limited and private limited companies will be 16 from 1955-56 to 1970-71, for small public limited comapanies it will be only 14 from 1956-57 to 1969-70 and will be only 13 from 1958-59 to 1970-71 for Government companies because of non-availability of data for these aggregates for the earlier years.

III. Cross-Section Analysis:

3.1. Using cross-section data of 33 industries, eachnconsisting of medium and large public limited companies included in RBI surveys mentioned in chapter II, we tested the 8 hypotheses concerning the business demand for money as mentioned in chapter III. 21 regression equations were computed for each equation representing 21 years from 1950-51 to 1970-71 for all the 8 equations for both definitions of money. Thus the cross-section analysis is based on a total of 332 regressions. The results are given below.

3.2. Definition of Money: In order to put the theories in their best light we try to find out the empirically most preferable definitions of money. There are two definitions of money. One a narrow definition of money according to which money comprises of cash plus demand deposits alone. The other is a somewhat a broader definition of money in that it includes also time deposits.

There is no unanimity regarding which of them is the right definition. Hence, it has become a common practice to use both the measures in empirical analysis and select the one which performs better in terms of predictive power. We also follow the established method. The results are given in table (1) below.

Table 4.1

The Relative Predictive Performance (R^2) of two Definitions of Money: Total Number of Cross-section Regression Equations: 21 From 1950-51 to 1970-71

Cross-section Regression Equation Number	$\bar{R}^2(M_2)$ Greater Than $\bar{R}^2(M_1)$	$\bar{R}^2(M_2)$ equals $\bar{R}^2(M_1)$	$\bar{R}^2(M_1)$ Greater than $\bar{R}^2(M_2)$
CS1	20	1	Nil
CS2	19	2	Nil
CS3	20	1	Nil
CS4	21	Nil	Nil
CS5	19	2	Nil
CS6	20	1	Nil
CS7	15	6	Nil
CS8	18	3	Nil

From the above table it is evident that the broader definition of money namely M2 performs extremely well. Out of the total of 168 regressions, in 152

equations its explanatory or predictive power is significantly higher than that for M1. In the rest 16 regressions, its predictive power is as good as for M1. In not even a single regression M1 has performed better than M2. In particular for the modified Meltzerian model (CS_4) M2 comes out as the best for all the 21 year cross-section regressions. Incidentally it should be noted that it is this MM model, is the, one which we are going to claim as the most appropriate model for explaining the business demand function for money in India.

3.3. Using M2 as the definition of money the results that were obtained from 21 cross-section individual year regression equations for each of the 8 regression equations which represent the models of business demand for money are summarised in the table below (4.2).

3.4. The above table (4.2) gives in the following information about the regression equations computed:

(i) The arithemetic average, the lowest value, the highest value and the coefficient of variation of $\bar{R}^2$ for each of the 8 individual year cross-section regresion computed for each of 8 regression equations. This summary statistics will help us in evaluating the level and variability (or in other words the stability) of the predictive or explanatory power of models.

(ii) It gives us the information on the level of statistical significance of the constant term in the

Table 4.2

Summary Statistics of Temporal Cross-Section Regression Equations of 8 Hypotheses in the Business Demand for Money: Number of Observations: 33, Number of Regressions Per Equation: 21

CSRE	Lowest $\bar{R}^2$	Highest $\bar{R}^2$	Average $\bar{R}^2$	Coefficient of variation	Significance of Constraint Term	
					at 99% confidence level	at 95% confidence level
CS1	.36	.55	.48	10.8	Nil	2
CS2	.42	.69	.57	14.6	9	12
CS3	.51	.78	.62	39.06	7	8
CS4	.56	.79	.66	10.01	10	15
CS5	.01	.28	.06	Nil	21	21
CS6	.02	.31	.10	Nil	21	21
CS7	.02	.38	.20	Nil	21	21
CS8	.02	.12	.06	Nil	21	21

CSRE = Cross Section Regression Equation.

CS1....CS8 refer to the cross-section regression equations as specified in chapter III section X. The 1st parameter refers to the 1st elasticity coefficient as it appears in the regression equations and the 2nd parameter refers to the 2nd elasticity coefficient in the regression equations.

Figures in brackets in CS4 refer to the values computed for the period 1959-60 to 1970-71 i.e. after the structural break in the function.

IS = Insignificant; NC = Not Computed.

Contd...

Table 4.2 contd.

CSRE	1st Parameter			Coeffi-cient vari-ation	Significance of the 1st Parameter	
	Lowest Value	Highest Value	Average		At 99% confi-dence level	At 95% confi-dence level
CS1	.54	.91	.68	14.41	21	21
CS2	1.51	1.15	.90	27.62	21	21
CS3	-.55	.37	NC	NC	Nil	Nil
CS4	.72	1.15	.90	15.6	21	21
			(.79)	(6.33)		
CS5	-.001	.008	NC	NC	Nil	Nil
CS6	-.01	.01			Nil	Nil
CS7	IS					
CS8	IS					

Contd...

Table 4.2. contd.

CSRE	The Number of Regressions with collect sign	2nd Parameter				Significance of the 2nd parameter		No.of Regressions with correct signs.
		Lowest Value	Highest value	Average	Coeffi-cient of variation	99%	95%	
CS1	All							
CS2	All							
CS3	12	.24	1.11	.85	NC	20	21	All
CS4	All	.71	1.31	.93 (.80)	17.73 (10.6)	21	21	All
CS5	20							
CS6	13	-.11	.59			Nil	Nil	13
CS7	All							
CS8	All							

regression equation.

(iii) The arithemetic average, the lowest value, the highest value, the coefficient of variation, the level of significance and the correctness of the algebraic sign of the parameter are also given for all the parameters in the regression equation.

3.5. On the basis of the information given in the table above we can infer the following

(i) CS7 and CS8 are equations representing the Tobins' two hypothesis namely

(a) the ratio of cash to total transactions balances i.e the ratio of M2 to monetary assetcs (MA), is not independent of the volume of transactions

(b) the ratio of cash holdings (M2) to the volume of transaction (Y) will vary inversely with the volume of transactions.

Both these hypotheses are rejected in the Indian business context as the regression equations have registered the lowest $\bar{R}^2$ and insignificant parameters.

(ii) Of the rest 6 regression equations representing models of business demand for money, CS5 and CS6 representing the combined classical-Keynes-Baumol-Tobin approach also faired very badly. The average $\bar{R}^2$ is as low as .06 for CS5 and .10 for CS6. And a closer scrutiny further shows that none of the estimated parameters are significant nor the expected algebraic sign of the

parameters are realized consistently. So our discussion will center round the 1st four regressions equations CS1 to CS_4.

(iii) Of the competing four regression equationsthe regression equation (CS_4) representing the modified Meltzers' model comes out to be the best in terms of its predictive (or explanatory) power $\bar{R}^2$, the correctness of the algebraic signs of the estimated parameters according to expectation, high level of statistical significance of these parameters, comparatively more stable nature of the estimated parameters over time and the high reliability of the estimated parameters because of absence of any major econometric estimation problem in the estimation of this model.

The average predictive performance of the modified Meltzers' model (MM) is the highest. It is as high as .66 in comparison to .62 of Marshalls' model, .57 of wealth model and .48 of classical model. Incidentally it should also be noted that it is this (MM) model which registers the highest $\bar{R}^2$ for all the equations. The coefficient of variation of $\bar{R}^2$ is the lowest for MM model. It is only 10.01% for MM model in comparison to 39.06% for Marshalls' model, 14.6% for wealth model and 10.8% for the classical model. This shows the relatively more stable nature of the explanatory power of the MM model.

With regard to the correctness of the algebraic signs and the magnitudes of the estimated parameters, and their

level of statistical significance in terms of t tests also the MM models fairs far better than the rest. The estimated parameters for all the 21 yearly cross-section regressions have the correct algebraic sign, magnitudes and high t values which shows their high statistical significance. In comparison to this other models fair poorly. For the Marshallian regression equation 9 out of 21 regressions have wrong signs for the income elasticity parameter and in all the 21 regression equations the income elasticity parameter comes out to be statistically insignificant with low t values. For classical and wealth models even though the estimated parameters for all the 21 regressions for both models have the correct algebraic signs and high statistical significance their magnitudes are not according to expectations.

With regard to the stability of the parameters over time, again MM performs better than all other models. Before we compare and evaluate the performance of these models in terms of the relative stability of the estimated parameters over time we should like to bring to notice two points

(i) We have not computed the coefficient of variation of the estimated parameters for the Marshallian model because income elasticity coefficient has wrong algebric signs and statistically insignificant. So for this comparison, we have left out the Marshall model.

(ii) For MM model we have computed the coefficient of variation of the estimated parameters in two ways

(a) By taking into account all the 21 years

(b) By taking into account only the post-structural-change years (i.e. from 1959-60). For other models we computed the coefficient of variation on the basis of all 21 regression as they do not show any structural change.

A comparison of the coefficient of variation of the income elasticity parameter of the classical model (CS1 first parameter) with the income elasticity coefficient of the MM model (CS_4 first parameter) shows that if we use all the 21 year regressions then the coefficient of variation of the estimated income elasticity coefficient is slightly more stable than the MM model but if we take into account the structural change in the MM model then the stability of the the estaimted income elasticity parameter in the MM model performs better than the classical models. The MM models' coefficient of variation after the structural change is as low as 6.33% in comparison to 14.41 of classical model. The wealth elasticity coefficient has a high coefficient of variation than the rest of the equations. Thus in terms of stability of parameters over time also MM model performs better than others.

Lastly MM model is a far better specified model than the rest. In the estimation of MM models' regression equation we did not face any econmetric problems such as

auto-correlation, multi-collinearty etc. whereas Marshalls' model exhibits multi-collinearity problem and the classical and wealth models suffer from inadequate specification of the function.

We can make a few more observations which will be worthy of note. Both classical and wealth model regressions (in contrast to the expectations of the classical economists and Meltzer that there are no economies of scale) show that there are economies of scale in the holding of cash balances supporting the Baumol-Tobin analysis; but they do not support the contention of the Baumols' inventory theoretic model which says the elasticity of money with respect to income or volume of transactions is .5 (one half). It supports the views of Professor Kamta Prasad and others that it will be between .5 and 1. This they derived by relaxing one of the unrealistic assumptions of Baumols' model which we have already noted in an earlier chapter.

3.6. Modified Meltzer Model: Having established the superiority of MM model in depicting the business demand for money, let us now see more closely the results we obtained from 21 individual year cross-section regressions. The details are given in the table 4.3..

From the table 4.3 it can be seen that the elasticity coefficient of (W/Y) has changed from being above unitary to considerably less than unitary from the year 1959-60. Similarly the income elasticity of demand

Table 4.3

Temporal Corss-Section Regressions for 21 Years (1950-51 to 1970-71) for the Modified Meldtzer Model

$$\log M = \log A_4 + a_4 \log Y + b_4 \log (W/Y)$$

Year	$\bar{R}^2$	D.W.	Constant A_4	(W/Y) Elasticity (b_4)	Income Elasticity (a_4)
1950-51	.61	1.71	-3.48	.96	1.04
			(-2.65)	(3.05)	(6.49)
1951-52	.77	2.20	-3.39	1.31	1.04
			(-4.12)	(6.10)	(9.36)
1952-53	.72	1.64	-3.86	1.06	1.11
			(-3.96)	(4.32)	(8.40)
1953-54	.75	1.42	-4.01	1.09	1.14
			(-4.19)	(4.56)	(8.85)
1954-55	.70	1.39	-4.22	1.11	1.15
			(-3.78)	(4.09)	(7.76)
1955-56	.79	1.56	-3.60	1.08	1.08
			(-4.23)	(5.44)	(9.68)
1956-57	.70	1.94	-2.91	1.06	.97
			(-2.98)	(4.39)	(7.86)
1957-58	.59	1.62	-2.29	1.06	.87
			(-2.51)	(4.11)	(7.05)
1958-59	.66	2.04	-2.69	1.05	.92
			(-2.51)	(4.11)	(7.05)

Contd...

Year	$\bar{R}^2$	D.W.	Constant A_4	(W/Y) Elasticity (b_4)	Income Elasticity (a_4)
1959-60	.56	2.47	-1.08	.71	.76
			(-1.01)	((2.81)	(5.83)
1960-61	.70	2.37	-1.62	.71	.81
			(-1.85)	(3.57)	(7.88)
1961-62	.63	2.22	-1.41	.73	.78
			(-1.43)	(3.14)	(6.77)
1962-63	.66	2.40	-1.65	.99	.80
			(-1.68)	(4.28)	(7.10)
1963-64	.73	1.92	-2.72	0.95	.83
			(-3.13)	(4.89)	(9.17)
1964-65	.61	2.20	-1.70	.87	.81
			(-1.72)	(3.25)	(7.07)
1965-66	.58	2.24	-.99	.76	.73
			(-1.02)	(3.32)	(6.58)
1966-67	.58	2.24	-1.31	.81	.75
			(-1.28)	(3.40)	(6.58)
1967-68	.68	2.16	-2.08	.79	.82
			(-2.31)	(3.66)	(8.23)
1968-69	.60	2.15	-1.89	.78	.81
			(-1.79)	(3.11)	(6.96)
1969-70	.59	2.08	-1.37	.77	.78
			(-1.29)	(3.04)	(6.71)
1970-71	.65	2.19	-.76	.78	.72
			(-.88)	(3.83)	(7.73)

D.W. Durbin-Watson 'D' statistic. ( ) = 't' values

for money from being greater than unity has changed to considerably less than unity from 1959-60. In order to find out whether the elasticity coefficient is significantly different from unity or not we have adopted the t test in which

$$t = \frac{\text{the value of the estimated parameter-1}}{\text{the standard error of the estimated parameter}}$$

And if t comes out to be greater than the tabulated value in the t tables then we reject the null hypothesis that the value of the parameter is unitary.

The results from these 't' tests which were performed at 99% confidence level are given in the table below (4.4).

Table 4.4

Name of the Parameter	The value of the Parameter		
	Unity	Less than unity	greater than unity
Income elasticity	9 (1950-51 to 1958-59)	12 (1959-60 to 1970-71)	0
(W/Y) elasticity	21	0	0

From the above table it is evident that there has occured a structural change in the business demand function after 1958-59 by shifting the income elasticity of business demand for money from being unity to less than unity. This means that there were no economies of scale in holding cash balances prior to 1959-60. From 1959-60 onwards it appears that the level of transactions started giving

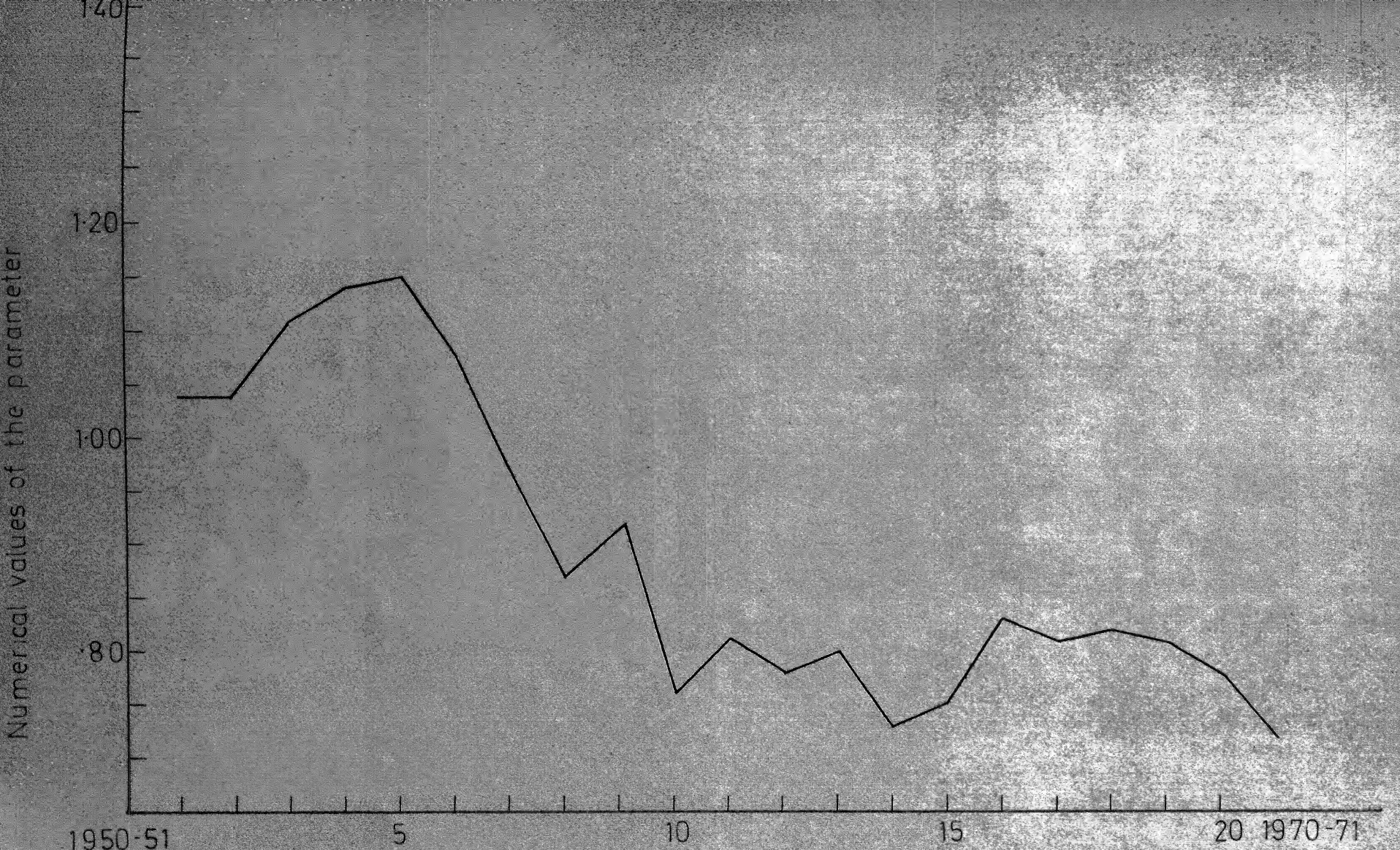

FIG-1

THE VARIATIONS OF THE INCOME ELASTICITY PARAMETER OVER TIME

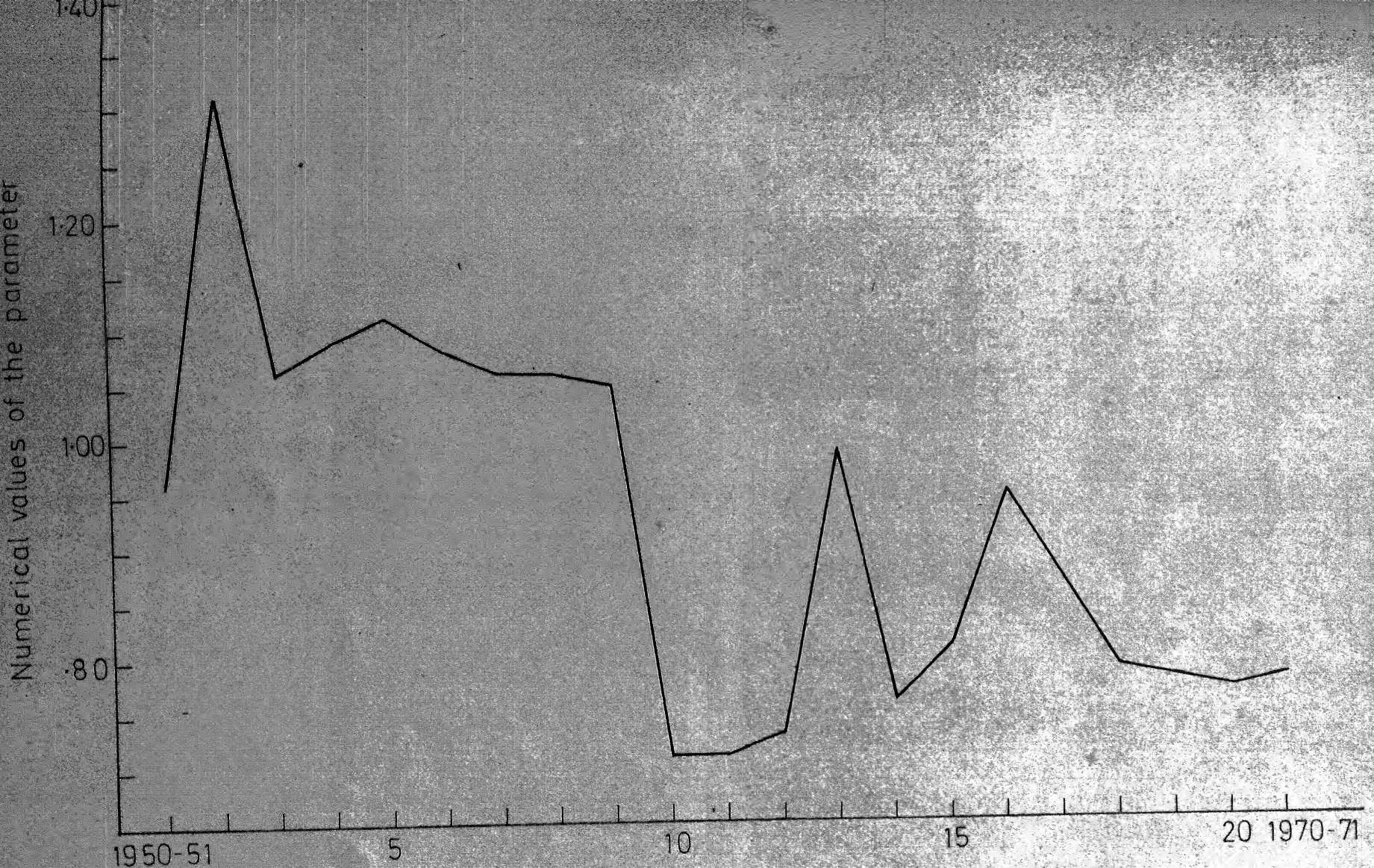

FIG. 2

THE VARIATIONS OF THE (WEALTH INCOME) ELASTICITY PARAMETER OVER TIME

The five categories are

(i) Aggregate of all public limited companies (Total of all small, medium and large companies)

(ii) Aggregate of all medium and large public limited companies

(iii) Aggregate of all small public limited companies

(iv) Aggregate of all medium and large private limited companies

(v) Aggregate of all Government companies

4.2. We have already discussed at length the time-series specification of business money demand functions in section X of chapter III. There are altogether 6 time-series money demand functions (TS1 to TS6).

4.3. Empirical Definition of Money: In order to find out whether there is consistency between cross-section analysis and time series analysis in choosing the most appropriate empirical definition of money, we computed time series regression equations for the above mentioned five categories for both definitions of money. For all the five categories the broader definition (M2) of money performed better than M1. Out of the total of 30 regressio (6 equations for each of the five categories) in 28 regressions M2 performed better than M1 and in the other two M2 has performed in terms of $\bar{R}^2$ as good as the other definition M1.

Thus from both cross-section and time-series analyses we get the identical result with regard to the most appropriate empirical definition of money which comes out to be the broader definition of money M2.

4.4. The results that were obtained from 6 time series regression equations for each of the five categories or aggregates are given in table 4.5 to.4.9.

Following the same procedure as we had adopted in evaluating the cross-section regression equations in the last section here also, we find that in terms of explanatory power ($\bar{R}^2$), with correct algebraic signs of the estimated parameters and with high level of statistical significance of these parameters in terms of t values, the modified Meltzers' model has come out to be the best among the lot for all the 5 categories. In comparison to this all other models have performed poorly in every respect. In two out of the five categories the interest rate variable has turned out to be insignificant. In the case of wealth model also similar phenomenon is observed.

In the Marshallian model we observe that income elasticity coefficient has turned to be statistically insignificant in 3 out of 5 categories. Similarly in 3 out of 5 regressions of the Marshallian model the interest elasticity coefficient has come to be statistically insignificant.

Table 4.5

Total of all Medium and Large Public Limited Companies: Time-Series Regression Equations

TSRE	R^2	D.W.	00	01	02	03	04	05
TS1	.88	1.26	1.08	.74*	-.82			
			(1.45)	(9.75)	(-1.50)			
TS2	.86	.96	1.38	.72*	-.77			
			(1.58)	(7.87)	(-1.17)			
TS3	.90	1.86	.79	2.22*	1.49*	-1.64		
			(1.25)	(3.89)	(2.61)	(-1.40)		
TS4	.95	1.96	.79	.73*	1.48*	-1.64**		
			(1.25)	(11.54)	(2.80)	(-1.80)		
TS5	.90	1.81	-1.16	.94*	-.96**	-.23	.46**	.05
			(-1.35)	(4.86)	(-2.36)	(-.81)	(2.40)	(.12
TS6	.84	1.99	1.59	.72*	-1.88**	.29	-.33	-5.64
			(1.10)	(3.48)	(-3.75)	(1.13)	(-.73)	(-3.56

TSRE = Time-series Regression Equation

D.W: Durbin-Watson 'D' statistic

't' values are within brackets

00 = Constant Term in the regression equation

01,02 refer to regression paramters as they appear sequentially in regression equations (TS1...TS6) as specified in chapter III, Section X.

* 't' significant at 99% level of confidence

** 't' significant at 95% level of confidence

(All the tables follow the same pattern of presentation)

Table 4.6

Total of all Small Public Limited Companies

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.92	2.65	.74	.68*	-.67*			
			(1.99)	(11.22)	(-2.47)			
TS2	.91	2.72	.21	.74*	-.49**			
			(.61)	(18.49)	(-2.09)			
TS3	.93	2.84	.33	.18	.55**	-.55**		
			(.84)	(.65)	(1.85)	(-2.13)		
TS4	.98	2.51	.33	.72*	.55**	-.55**		
			(.84)	(15.84)	(1.85)	(-2.13)		
TS5	.95	2.75	.09	.23	-.26	.25**	1.35**	-1.43**
			(.18)	(1.62)	(-.83)	(2.82)	(2.87)	(-2.45)
TS6	.93	2.08	.91	.63*	-1.50**	.44	-.43	-3.64
			(1.23)	(9.45)	(-1.97)	(.65)	(-.62)	(-1.32)

Table 4.7

Total of all Public Limited Companies
(Small, Medium and Large)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.89	1.38	.45	.79*	-.79**			
			(.68)	(11.32)	(-1.89)			
TS2	.88	1.02	.91	.76*	-.80			
			(1.09)	(8.50)	(-1.46)			
TS3	.93	1.92	.11	1.84*	-1.05**	-1.61		
			(.18)	(3.89)	(-2.24)	(-1.68)		
TS4	.96	1.95	.10	.73*	1.06**	-1.61**		
			(.18)	(13.22)	(2.25)	(-1.88)		
TS5	.92	1.83	-1.42	1.08*	-1.16**	-.41	.26	.62
			(-1.30)	(3.99)	(-2.40)	(-1.14)	(.96)	(.91)
TS6	.90	2.28	.21	.74*	-1.05	.15**	.11	-4.54*
			(.27)	(4.37)	(-1.85)	(2.64)	(.25)	(-4.05)

Table 4.8

Total of all Medium and Large Privated Limited Companies

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.86	1.55	.95	.65	.98			
			(1.62)	(9.65)	(-1.95)			
TS2	.88	1.50	.73	.74*	-.74**			
			(1.45)	(11.26)	(-2.05)			
TS3	.91	1.71	.94	.47	0.32	-.69**		
			(1.80)	(1.22)	(.50)	(-1.91)		
TS4	.95	1.91	.92	.69*	1.32**	-.79**		
			(1.80)	(8.99)	(2.50)	(-1.91)		
TS5	.92	2.06	1.18	.54*	-.88**	.15	.36	.35
			(1.85)	(4.46)	(-2.18)	(.97)	(1.85)	(.91)
TS6	.85	1.95	-.40	.45*	-.98	-.84**	-.17	-3.88**
			(-.37)	(3.31)	(-1.77)	(-2.73)	(-.35)	(-2.40)

Table 4.9

Total of All Government Companies

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.89	2.05	-2.36	.73*	-1.77**			
			(-2.02)	(12.84)	(-2.01)			
TS2	.90	2.69	1.03	.70*	-.65			
			(1.12)	(16.41)	(-.85)			
TS3	.92	2.67	.58	.10	.60**	-.35		
			(.34)	(.32)	(2.10)	(-.28)		
TS4	.98	2.67	.58	.70*	.60**	-.35		
			(.34)	(14.26)	(2.10)	(-.28)		
TS5	.91	2.45	2.41	1.14*	2.44	-1.62	-.93	-.27
			(.47)	(3.57)	(1.51)	(-1.31)	(-.90)	(-.01)
TS6	.89	2.66	-1.32	.35**	1.46	.71**	-2.37	3.24
			(-.55)	(2.81)	(.89)	(2.48)	(-1.65)	(.59)

Two important variables namely the general price level and the expected change in the general price level whose presence in the regression equation (TS5) of the balance sheet approach model differentiates the (TS5) equation from (TS4) have very insignificant elasticity coefficients. (Here it should be noted that the other 3 variables in the balance sheet approach model are also there in the modified Meltzer model. The rate of return on physical assets is actually included in the variable index (W/Y) which is a proxy variable for changes in capital/labor ratio, capital use, and internal rate of return.) In two out of 5 regressions and five out of 5 regressions both these variables namely the general price level and the expected change in the general price level have come out to be statistically insignificant.

Similarly in the case of neo-classical production theory model where money is regarded as a productive input, the statistical significance of such new variables as the factor price ratio (c/w), the expected change in the general price level P'/P and the expected change in the price of Government securities have come out to be statistically insignificant in the majority of equations.

Thus the higger models TS5 and TS6 do not add any thing positively to the predictive power of the model of business demand for money.

Finally from these observations it becomes clear

that the performance of the wealth-income ratio as a better proxy variables representing the changes in internal rate of return, capital intensity, utilization index etc. then variables such as R, P'/P, c/w etc.

4.5. Having established that the modified Meltzer model is the best among the lot in explaining the business demand for money, let us now investigate in detail the results that we got from this regression equation.

Explanatory Power: The explanatory power of the MM model varies from .98 for Government companies to .95 for public limited companies with an average of .964. Thus in the time series regressions it has lesser variability than in cross-sections.

Income Elasticity: Secondly the income elasticity of demand for money further confirms the cross-section finding that there are economies of scale in the holding of cash balances and that the income elasticity of demand for money is less than unitary. In all the five aggregates the income elasticity of money has come out to be significantly less than unitary.

Thirdly there seems to be no difference produced in the income elasticity of demand for money because of differences in the nature of ownership and the size of business concerns. All the five categories have almost identical income elasticity of demand The values for the

five categories are .73, .72, .73, .69 &.70 which are very close to one another. Thus size and ownership differences have not made any impact on the income elasticity of demand for money.

The similarity of this income elasticity of demand for money for all the aggregates is a theoretically expected result because the institutional structure determining the income-expenditure streams is identical for all the categories of the business sector.

(W/Y) Elasticity: In contrast to the unitary elasticity value that we derived for this variable in the cross-section analysis of medium and large public limited companies, its value for medium and large public limited companies is 1.48 even though it is not statistically significantly different from one as the t values show. For small public limited companies its value is .55 and for medium and large private limited companies and Government companies its values are .22 and .60 respectively.

Thus size and the type of ownership seem to make differences in the (W/Y) elasticity of demand for money. This is quite logical and expected because of differences in utilization of wealth, internal rate of return, capital intensity etc.

Interest Elasticity: Interest elasticity of demand of all the categories except Government companies have nearly

equal values of -.64, -.55, -.61 & -.69. Only for Government companies its value is very low as -.35 and also statistically insignificant. In other words the rate of interest on Government securities has no significant effect on the demand for money in the case of Government companies. This may be due to the reason that Government securities are not having any important position in the assets portfolio of Government companies.

V. A Comparison of Cross-Section and Time-Series Estimates of Elasticity Parameters:

5.1. This comparison is possible only for medium and large public limited companies simply for the reason that both cross-section and time-series analyses were done only for this category. For the other categories, data were not available at disaggregated industry levels to make cross-section analysis.

5.2. This comparison of cross-section and time-series estimates of elasticity parameters appear in the table below for three models which have been seen to be better namely Keynesian, wealth and modified Meltzer model for 3 variables namely income, wealth and ratio of wealth to income (W/Y).

From the table it is evident that there is consistency between cross-section estimates and time-series estimates. Both have the same algebraic signs. Of the

3 elasticity coefficients the income elasticity coefficient exhibits greater consistency between cross-section and time

Table 4.10

Comparison of Cross-Section and Time-Series Estimates

Model	Value of Income Elasticity		Value of Wealth Elasticity		Value of (W/Y) Elasticity	
	Cross-Section estimate	Time-series estimate	CS estimate	TS estimate	CS esti-mate	TS esti-mate
Keynesian equation	.68	.74	-	-	-	-
Wealth equation	-	-	.90	.72		
Modified Meltzer equation	.79	.73	-	-	.83	1.48

series estimates followed by wealth and (W/Y) elasticities. In particular the (W/Y) elasticity coefficient has very high variability. It is because in cross-section equations we take into account only the inter-industry variations in (W/Y) (which is actually an index measuring inter-industry differences in such factors as internal rate of return, capacity utilisation, capital intensity etc) whereas in time-series analysis there occurs inaddition to inter-industry differences, inter-year variations in the above mentioned factors. So it is quite likely the (W/Y) elasticity will be higher in time-series estimates.

VI. Conclusion:

The following conclusions can be established on the basis of the results that we obtained in the cross-section and time-series analyses of Indian business data.

(i) Empirically the most appropriate definition of money is cash balances plus demand deposits plus time-deposits i.e. M2.

(ii) The most appropriate model of business demand for money for Indian business sector is the modified Meltzer model. The independent variables explaining the movements in the business demand for money are income, wealth-income ratio which is actually a proxy variable measuring the changes in business climate, capacity utilisation, capital intensity etc., and the rate of interest. In particular the income elasticity of demand for money is less than unity which shows the presence of economization in the holding of cash balances. And also this provides a stable demand function since 1958-59.

(iii) There occured a structural break in the business demand function in the year 1958-59. Prior to that the income elasticity of demand for money was unity. Since then it changed to less than unity indicating economization of cash balance holdings.

(iv) There exists consistency in cross-section and time-series estimates of elasticity coefficients.

(v) Year to year variations in elasticity coefficients do not seem to have any time trend but they exhibit only random variations.

(vi) Type of ownership and size of firms do not seem to have any significant impact on the nature of business money demand functions.

CHAPTER V

Disaggregate Analysis of Business Demand for Money

I. Introduction:

1.1. In this chapter we will make an attempt to study the disaggregated nature of business demand for money in terms of two levels ofddisaggregation namely (i) sectoral disaggregation (ii) industrial activity disaggregation for the same set of time series specification of demand functions.

1.2. Sectoral Disaggregation: On the basis of the nature of the economic activity of the industries and the types of products produced we can divide the whole business sector into four main activity sectors namely

(i) Agricultural and Allied Activities (AAA)

(ii) Mining and Quarrying (MQ)

(iii) Processing and Manufacturing

- (a) Consumer goods industires (CGI)
- (b) Capital and Industrial Intermediate goods industries (CIGI)
- (c) Consumer Intermediate goods Industries (COIGI)

(iv) Tertiary or Services Activities (TSA)

Thus including the subgroups of the processing and manufacturing sector as separate categories we have altogether 6 groups of industrial (or business)activities sectors.

The specific list of industries which come under each of these above mentioned six groups are listed in the appendix to chapter II.

1.3. Industry Disaggregation: According to the type and nature of products that firms produce we can divide the whole business sector into 33 industries. The list of these 33 industries are given in the appendix to chapter II.

1.4. Due to non-availability of data for the medium and large private limited companies for each of the 33 industries we could not carry out inter-industry study for them. We have carried out only inter-sectoral study for which data were available. For public limited companies we have carried out both inter-sectoral and inter-industry analyses.

1.5. The objectives of this chapter are:

(i) To find out the micro or disaggregate money demand functions of the Indian business sector in terms of sectoral and product disaggregation and to observe the kind of relationship that exists between the micro (or disaggregate) money demand functions and macro (or aggregate) money demand functions.

(ii) To find out whether there are any inter-sectoral, or inter-industry differences and inter-institutional (on the basis of pattern of ownership of firms we have already divided the whole business sector into public

limited and private limited companies) differences in money demand functions and if so, the extent and magnitudes of such differences.

(iii) And if there are such inter-industry differences, then to adopt a homogeneity criteria to reclassify the industries into different groups of industries on the basis of the nature of individual industry money demand functions.

II. Sectoral Analysis of Business Demand for Money:

2.1. The time-series regression equations using individual sectoral data of the six broadly defined business sectors are given in tables 5.1 to 5.6 for medium and large public limited companies and 5.7 to 5.12 for medium and large private limited companies. Let us discuss the regression results that were obtained for these two major business sector categories, namely public limited and private limited companies, individually first and together then.

2.2. Medium and Large Public Limited Companies: On the basis of the criteria that we have developed in chapter IV for evaluating the empirical relevance and significance of models (in terms of the predictive (or explanatory) power (R^2), the correctness of the algebraic signs of the estimated elasticity parameters, their magnitudes and statistical significance in terms of t values and absence of any major econometric estimation problems) the modified

Table 5.1

Medium and Large Public Limited Companies (MLPULC)
Agricultural And Allied Activities (AAA).

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.28	1.98	7.08	.22	-1.73			
			(7.47)	(1.77)	(-2.21)			
TS2	.26	1.95	5.90	.33	-1.64			
			(3.91)	(1.56)	(-2.05)			
TS3	.51	1.99	3.98	.66	.76	-1.71		
			(2.35)	(1.03)	(.70)	(-2.14)		
TS4	.62	1.96	2.98	.85	.76	-1.68		
			(1.35)	(3.20)	(1.90)	(-2.14)		
TS5	.68	2.61	4.44	1.49	-1.83	1.03	-.6-	-.41
			(3.47)	(3.66)	(-2.54)	(0.21)	(-1.50)	(-.45)
TS6	.59	2.70	5.51	0.134	-4.19	-.73	.09	-16.39
			(7.64)	(0.44)	(-4.65)	(-1.83)	(0.10)	(-5.26)

Reg., Equation	Degrees of Freedom	Critical values of 't' Confidence levels 99%	95%
TS1 & TS2	13	2.65	1.77
TS3 & TS4	12	2.68	1.78
TS5 & TS6	10	2.76	1.81

(Applicable to all Tables that follow)

Table 5.2

(MLPULC): Mining and Quarrying (MQ)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.59	1.52	-1.56	.93	-.92			
			(-.83)	(3.52)	(-.56)			
TS2	.56	1.38	.95	.73	-1.55			
			(.54)	(3.32)	(-.84)			
TS3	.65	1.51	-1.11	.76	.14	-1.10		
			(-.37)	(.87)	(3.20)	(-1.57)		
TS4	.69	1.51	-1.11	.90	1.14	-1.10		
			(-.37)	(3.00)	(2.20)	(-1.57)		
TS5	.64	1.57	-2.61	3.87	-1.46	-3.35	-1.48	2.37
			(-.86)	(1.95)	(-.72)	(-1.39)	(-1.59)	(.78)
TS6	.34	1.73	-3.91	1.93	-2.28	-.06	-.64	-9.19
			(-.85)	(1.39)	(-.79)	(-.13)	(-.22)	(-1.01)

Table 5.3

(MLPULC): Consumer Goods Industries (CGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.84	1.79	1.31	.90	-2.85			
			(1.30)	(8.10)	(-4.59)			
TS2	.86	1.83	1.38	.96	-3.15			
			(1.48)	(8.72)	(-5.23)			
TS3	.88	1.79	1.45	.34	1.32	-3.25		
			(1.47)	(.36)	(2.32)	(-4.81)		
TS4	.92	1.79	1.42	.68	1.26	-2.25		
			(1.05)	(7.95)	(2.25)	(-4.82)		
TS5	.89	1.54	3.30	.31	-3.06	.75	.75	-.20
			(1.97)	(.81)	(-4.29)	(1.73)	(1.47)	(-.18)
TS6	.73	1.69	2.01	1.02	-1.75	.95	-.72	-.45
			(.78)	(1.93)	(-1.06)	(1.25)	(-1.04)	(-.96)

Table 5.4

(MLPULC): Capital and Industrial Intermediate Goods Industries (CIGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.94	1.64	-.12	.78	-.54			
			(-.16)	(10.27)	(-1.75)			
TS2	.90	1.41	-.08	.74	-.25			
			(-.09)	(7.88)	(-1.08)			
TS3	.95	1.77	-.06	2.25	1.46	-.65		
			(-.11)	(4.72)	(1.11)	(-1.16)		
TS4	.97	1.77	-.06	.69	1.46	-1.62		
			(-.11)	(13.44)	(3.11)	(-2.17)		
TS5	.94	1.89	-1.97	.64	-.51	.33	.75	.16
			(-1.76)	(1.86)	(-.69)	(.51)	(1.68)	(.17)
TS6	.87	1.98	-.11	.77	-1.31	.23	.95	-2.43
			(-.12)	(3.43)	(-1.27)	(.51)	(1.19)	(-.85)

Table 5.5

(MLPULC): Consumer Intermediate Goods Industries (CCIGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.52	.77	-2.14	.84	.49			
			(-.75)	(2.59)	(1.19)			
TS2	.50	.76	-2.27	1.00	.09			
			(-1.09)	(2.48)	(.63)			
TS3	.62	1.90	1.80	1.20	5.34	-3.38		
			(.61)	(1.13)	(0.95)	(-1.84)		
TS4	.69	1.92	1.83	.75	2.32	-2.31		
			(.61)	(2.14)	(1.95)	(-1.96)		
TS5	.65	1.61	-1.91	1.01	-0.24	-3.70	2.10	1.40
			(-3.05)	(3.48)	(-.13)	(-2.84)	(1.76)	(.52)
TS6	.58	1.63	-1.41	1.94	-1.85	3.73	-.75	-12.35
			(-2.34)	(3.39)	(-.58)	(2.11)	(-.27)	(-1.12)

Table 5.6

(MLPULC): Tertiary or Services Activities Sector (TSA)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.91	1.32	-2.50	1.04	-.58			
			(-2.70)	(8.92)	(-.91)			
TS2	.91	1.06	-2.73	1.07	-.63			
			(-2.91)	(9.00)	(1.00)			
TS3	.93	1.19	-2.67	.49	.58	-.64		
			(-2.79)	(.74)	(2.86)	(-1.19)		
TS4	.95	1.49	-2.27	1.08	.58	-.64		
			(-1.71)	(8.80)	(2.86)	(-1.99)		
TS5	.94	1.76	-1.23	1.24	-.79	-.19	-.97	.72
			(-.70)	(2.30)	(-1.10)	(-.29)	(-2.35)	(.63)
TS6	.69	1.55	.02	1.01	-2.15	-1.38	.22	-4.21
			(.01)	(2.49)	(-1.80)	(-2.34)	(.23)	(-1.31)

Table 5.7

Medium and Large Private Limited Companies (MLPRLC)
Agriculture and Allied Activities (AAA)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.89	2.45	-1.56	.57	-1.21			
			(-1.00)	(9.04)	(-1.38)			
TS2	.78	1.12	-4.78	.91	-1.31			
			(-1.74)	(5.94)	(-1.23)			
TS3	.90	2.37	-2.69	.47	.96	-.17		
			(-1.30)	(3.59)	9.95)	(.54)		
TS4	.92	2.37	-2.58	.69	.32	-.86		
			(-1.20)	(2.89)	(2.85)	(-1.86)		
TS5	.91	1.76	-2.25	.62	.33	.31	-.06	1.45
			(-.80)	(4.49)	(.28)	(.62)	(-.08)	(.90)
TS6	.90	2.02	-1.87	.59	-.26	-.06	1.31	-3.87
			(-.91)	(4.45)	(-.19)	(-.17)	(1.01)	(-.75)

Table 5.8

(MLPRLC): Mining and Quarrying (MQ)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.90	2.25	-3.95	.94	-1.22			
			(-2.37)	(8.75)	(-.89)			
TS2	.91	2.08	-4.63	.93	-1.22			
			(-3.37)	(8.13)	(-1.01)			
TS3	.92	2.24	-5.83	-.31	1.40	-1.30		
			(-2.67)	(-.72)	(2.10)	(-1.03)		
TS4	.94	2.14	-5.25	1.09	1.40	-1.30		
			(-1.67)	(4.34)	(2.10)	(-1.03)		
TS5	.93	2.28	-5.04	.96	-.47	1.60	.13	1.12
			(-3.12)	(7.18)	(-.53)	(1.23)	(.19)	(.68)
TS6	Insignificant results.							

Table 5.9

(MLPRLC): Consumer Goods Industries (CGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.70	.90	-.25	.71	-.90			
			(-.18)	(4.46)	(-.68)			
TS2	.76	1.30	-.73	.86	-1.20			
			(-.58)	(5.29)	(-1.01)			
TS3	.80	2.07	-1.38	-1.30	2.31	-1.18		
			(-1.09)	(-1.56)	(2.45)	(-1.04)		
TS4	.82	2.02	-1.28	0.81	2.13	-1.26		
			(-1.15)	(5.53)	(2.85)	(-1.94)		
TS5	.80	1.53	-2.66	.56	-.32	1.46	.81	-1.13
			(-1.16)	(1.06)	(-2.56)	(2.78)	(1.91)	(-1.59)
TS6	Insignificant results.							

Table 5.10

(MLPRLC) Industries
Capital and Industrial Intermediate Goods Industries (CIGI)
(CIGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.62	1.04	2.29	.51	-.65			
			(2.34)	(3.77)	(-.74)			
TS2	.60	1.05	2.36	.50	-.57			
			(2.37)	(3.58)	(-.64)			
TS3	.64	1.11	2.23	1.03	-1.26	-.66		
			(2.26)	(1.21)	(-.86)	(-.75)		
TS4	.67	1.45	2.29	.48	1.25	-.66		
			(1.26)	(3.39)	(1.86)	(-.75)		
TS5	.66	2.10	.81	1.07	-1.72	-1.75	.23	1.26
			(.55)	(2.84)	(-1.78)	(-2.16)	(.52)	(1.08)

TS6 Insignificant results.

Table 5.11

(MLPRLC): Consumer Intermediate Goods Industries (COIGI)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.58	1.47	5.60	.62	-3.92			
			(3.52)	(4.20)	(-2.50)			
TS2	.54	1.33	5.04	.71	-3.92			
			(3.06)	(3.84)	(-2.33)			
TS3	.67	1.73	6.98	1.18	.95	-1.29		
			(3.72)	(1.78)	(1.30)	(-2.05)		
TS4	.69	1.73	5.35	.78	1.75	-1.15		
			(2.75)	(2.75)	(2.30)	(-1.95)		
TS5	.55	1.55	5.98	.68	-4.15	-.10	.08	.50
			(1.05)	(1.26)	(-1.70)	(-.15)	(.05)	(.16)
TS6	Insignificant results.							

Table 5.12

(MLPRLC): Tertiary or Services Sector (TSA)

TSRE	$\bar{R}^2$	D.W.	00	01	02	03	04	05
TS1	.85	1.44	-1.37	.76	-.14			
			(-1.60)	(6.90)	(-.23)			
TS2	.87	1.57	-3.44	1.02	-.19			
			(-3.40)	(7.38)	(-.33)			
TS3	.89	1.63	-4.51	.42	1.26	-.24		
			(-1.72)	(.44)	(1.29)	(-.41)		
TS4	.92	1.72	-3.25	1.04	1.56	-.35		
			(-1.25)	(3.58)	(2.26)	(-1.41)		
TS5	.91	2.24	-1.92	.51	-.02	.39	.64	-.43
			(-2.09)	(3.05)	(-.03)	(2.49)	(1.62)	(-.51)
TS6	.79	2.65	-.53	.74	-.98	.33	.61	-2.52
			(-.55)	(4.76)	(-1.56)	(1.12)	(.83)	(-1.10)

Meltzer model (TS4) comes out as the best on the basis of each and every criteria mentioned above for four of the 6 business sectors namely

(a) Mining and Quarrying (b) consumer goods industries (c) capital and industrial intermediate goods industries and (d) consumer intermediate goods industries i.e., for two of the major four business sectors namely (i) Mining and Quarrying (ii) Processing and manufacturing.

In the case of tertiary or services sector modified Meltzer model has come out only marginally better than all other models. The explanatory power $\bar{R}^2$ of the modified Meltzer model (MM) is only slightly higher than that of the balance sheet model. The $\bar{R}^2$ for (MM) model is .95 whereas for the balance sheet model it is .94. But in terms of other criteria we have mentioned above the MM model performs for better than the balance sheet approach model. All the elasticity coefficients of the MM model are statistically highly significant and their algebraic signs and magnitudes are according to expectations whereas in the regression equation (TS5) representing the balance sheet approach model, the elasticity coefficients of the two most important variables (which distinguish and differentiate the balance sheet model from the MM model) namely the general price level variable and the expected change in the general price level variable are not only statistically insignificant but also have wrong algebraic signs.

In the case of Agriculture and Allied Activities (AAA) sector the balance sheet model comparatively performs better than the MM model in terms of the explanatory power $\bar{R}^2$ (its $\bar{R}^2$ is .68 compared to .62 of MM model) but both the price level variable and the expected change in the price level variable have come out with statistically insignificant elasticity coefficient. And also the income elasticity coefficient, contrary to expectations, is unduly high (1.49). In contrast to this, MM model has highly significant elasticity coefficients with correct algebraic signs and magnitudes. So if we take into account all the properties, then we can say MM model has performed equally well or even slightly better than the balance sheet model. -1.

Thus, we see that the MM model performs well at the sectoral level disaggregation also. Let us therefore, discuss the regression results obtained for this model for each sector along with the time series aggregate results that we got in the previous chapter so that we can compare and contrast the aggregate and disaggregate results.

Table 5.13

A Comparison of Aggregate and Sectoral Elasticity Coefficients

Elasticity of Demand for money with respect to	Aggregate estimate	Disaggregate estimates					
				Processing & Manufacturing			
		AAA	MQ	CGI	CIGI	COIGI	TSA
Income	.73	.85	.90	.68	.69	.75	1.08
Wealth-income ratio (W/Y)	1.48	.76	1.14	1.26	1.46	2.32	.58
Rate of interest	-1.64	-1.68	-1.10	-2.25	-1.62	-2.31	- .54

We can inter the following from the information provided in the above table (5.13).

(i) From above it is evident that as far as the qualitative nature of the relationship between money on the one hand and the independent variables namely income, wealth-income ratio (W/Y) and the rate of interest on the other hand is concerned the conclusion is the same for both macro or aggregate and micro or disaggregate units. But the magnitudes of the elasticity coefficients differ from sector to sector. So the macro or aggregate elasticity coefficients are only weighted averages of micro elasticity coefficients.

(ii) The income elasticity coefficients of the processing and manufacturing sector are significantly lower than unity confirming the hypothesis that there are

economies of scale in holding cash balances. In contrast to this the income elasticity of demand for money for the tertiary or services sector (TSA) is significantly equal to unity. For (AAA) Agriculture and Allied Activities and Mining and Quarrying sectors even though the numerical values of the income elasticity coefficients are less than one, the statistical t' tests do not reject the null hypothesis that they are equal to one.

(iii) From the inter-sectoral differences in the elasticity coefficients of the wealth-income ratio (W/Y) it is evident that the inter-sectoral differences in capacity utilization, capital intensity and internal rate of return of which (W/Y) is the proxy variable, have differing effects or influences on the business demand for money.

(iv) In comparison to the low effect that changes in rate of interest produces on the business demand for money of the AAA, MQ and TSA sectors, it produces greater effect on the business demand for money of the processing and manufacturing sectors.

Thus on the whole the processing and manufacturing sector of the medium and large public limited companies is more sensitive to changes in the independent variables than the rest of the sectors.

2.3. Medium and Large Private Limited Companies: On the basis of the criteria we have used so far in this study

for evaluating the empirical relevance and significance of theoretical models, we find the MM model yields better results than all other models in the case of medium and large private limited companies also.

On the basis of $\bar{R}^2$ and other criteria for all the sectors the MM model is the best. But compared to the high superiority that MM model enjoyed in terms of R^2 to all other models for the medium and large public limited companies, it does not have that much edge over other models for private limited companies which is evident from the information given in tables 5.7 to 5.12. But still in terms of other criteria such as the correctness of the algebraic sign of the estimated elasticity parameter, its magnitude and its statistical significance, the MM model enjoys absolute superiority over other models all of which have insignificant coefficients sometimes with wrong algebraic signs.

Having established that the MM model is empirically the most appropriate model, let us discuss the results that were obtained through regression equations along with the results that were obtained for the aggregate model so that we can compare and contrast them.

Table 5.14

A Comparison of Aggregate and Disaggregate Elasticity Coefficients

Elasticity of demand for money with respect to	Aggregate estimate	Disaggregate Estimates					
				Processing and Manufacturing			TSC
		AAA	MQ	CGI	CIGI	CCIGI	
Income	.69	.69	1.09	.81	.48	.78	1.04
Wealth-Income ratio (W/Y)	1.32	.32	1.40	2.13	1.25	1.75	1.56
Rate of interest	-.79	-.86	-1.30	-1.26	-.66	-1.15	-.35

From the above table the following inferences can be made.

(i) Income elasticity of demand for money is less than unity for all the subgroups of the processing and manufacturing groups and Agriculture and Allied Activities sector. They show substantial economies of scale in holding cash balances. Of particular interest is the capital and intermediate goods industry which confirms to the Baumols' inventory theoretical result of .5 income elasticity. In contrast to this Mining and Quarrying and Tertiary or Services Sectors do not show any economies of scale in holding cash balances. Their income elasticity of demand for money are unity.

(ii) Of all the sectors the consumer goods industries

sector is the most sensitive to changes in the rate of interest and the proxy variable (W/Y) which measures the cyclical changes in degree of utilization of assets, capital intensity, internal rate of return etc. The TSA is least sensitive sector for changes in the rate of interest and AAA is the least sensitive sector to changes in the (W/Y) variable.

2.4. A Comparison of Demand Function of Public Limited Companies with Private Limited Companies:

For the aggregate analysis all the elasticities of demand for money of the public limited companies are higher than that for the aggregate of private limited companies. particularly with respect to the rate of interest for the public limited companies the value of the elasticity of demand for money is almost double than that for private limited companies. It is -1.64 for the public limited companies in comparison to -.79 for private limited companies.

At the sectoral level for the agriculture and allied activities sector and the CIGI sector all the elasticities of the public limited companies are greater than that for the private limited companies. But all the elasticities of the private limited companies for the Mining and Quarrying sector are higher than that of the public limited companies for the same sector.

With respect to economies of scale in holding cash

balances both public and private limited companies have similar results. In both of them, the income elasticity of demand for money for the services sector is unity which implies that there are no economies of scale in holding cash balances. On the other hand, economies of scale exists for the processing and manufacturing, as well as agriculture and allied activities sectors in both of them.

With regard to MQ sector even though the estimates for public limited and private limited companies (1.09 for private limited and .90 for public limited) differ, statistically speaking the tests do not reject the null hypothesis that both of them are not statistically different from unity.

III. Inter-Industry Analysis of Business Demand for Money:

3.1. On the basis of industrial products produced and/or services produced we have divided the whole business sector into 33 distinct industires (see appendix 1 of chapter II) for the purpose of carrying out inter-industry analysis of medium and large public limited companies of their money demand functions.

3.2. Our objectives in this section will be

(i) To find out the specific money demand functions that are applicable to specific industries. In this context we will try to find out whether any one particular model is applicable to all industries or not.

(ii) Having found out the appropriate demand functions for each industry, we will try to find out in what respects inter-industry differences exist with respect to money demand functions.

(iii) Then on the basis of some homogeneous characteristics of industry demand functions we will classify them into distinct groups.

(iv) Finally we will make an attempt to compare the disaggregate results with the aggregate results we got in the previous chapter.

3.3. We have computed the time series regression for each of the 33 industries for all the 6 regression equations. Using the criteria of evaluating the empirical relevance and significance of economic models in terms of their explanatory power, $(\bar{R}^2)$, the correctness of algebraic signs of the estimated elasticity parameters and their magnitudes and the statistical significance of these elasticity parameters in terms of their t' values, we find that Modified Meltzer model has come out as empirically the most appropriate economic model describing the actual business money demand behavior for 17 out of the total of 33 industries. On the other hand, the balance-sheet model has come out as the most appropriate one for 5 industries and the neo-classical production theory model for another 2 industries, while for the rest 9

industries, none of the models performed well.

3.4. The nine industries for which none of these models fitted well are the following:

(i) Grains and pulses

(ii) Sugar

(iii) Non-ferrous metals

(iv) Matches

(v) Mineral oils

(vi) Cement

(vii) Construction

(viii) Land and Estate

(ix) Hotels, Restaurants and eating houses

For these 9 industries, all of the time-series regression equations mentioned earlier, have not only very low predictive power (ranging betwee .20 to .50) but also have wrong algebraic signs and magnitudes for the estimated elasticity parameters which are statistically insignificant.

3.5. The list of industries, and the details concerning the regression equations for which the modified Meltzer model has come out as the most appropriate model are given in table 5.15 and similarly for the balance sheet approach model and the neo-classical production theory model the details are given in tables 5.16 and 5.17 respectively.

Table 5.15

Modified Meltzer Regression Equation (TS4)

Industry	$\bar{R}^2$	D.W.	00	01	02	03
Coffee and Rubber Plantations	.72	1.68	-1.12	.78	.63	-1.70
			(-1.07)	(2.74)	(.30)	(-2.20)
Coal Mining	.67	1.48	1.08	.69	1.28	-1.14
			(.97)	(3.15)	(2.78)	(-1.78)
EVHO	.82	1.70	-1.19	.86	1.34	-1.37
			(-.45)	(6.12)	(4.67)	(-2.02)
SRWT	.83	1.34	1.97	.63	.64	-1.28
			(1.91)	(5.92)	(1.61)	(-2.91)
Aluminium	.72	1.97	-.29	.89	1.41	-1.43
			(-.05)	(4.86)	(2.28)	(-2.15)
TE	.79	1.31	1.25	.93	.08	-2.22
			(.46)	(3.38)	(.06)	(-2.61)
EMAA	.91	1.48	-1.17	.66	2.01	-1.64
			(-1.73)	(6.51)	(1.01)	(-1.84)
FNFMP	.97	1.89	-.86	.82	1.10	-1.24
			(-.29)	(6.57)	(2.42)	(-1.75)
BIC	.86	1.93	.05	.58	1.01	1.72
			(.02)	(4.43)	(.96)	(2.38)
MPP	.98	1.48	-.05	1.09	2.24	-1.83
			(-.39)	(13.53)	(1.93)	(-1.97)

contd...

Table 5.15 contd.

Industry	$\bar{R}^2$	D.W.	00	01	02	03
OCP	.88	2.36	-1.52	.79	1.40	-1.70
			(-.68)	(3.55)	(2.77)	(-1.78)
PCCEW	.89	1.41	-1.87	.78	2.39	-2.25
			(-1.84)	(6.47)	(1.85)	(-1.89)
RRP	.91	2.03	-1.61	.90	2.01	-1.93
			(-1.35)	(5.39)	(.05)	(-2.27)
PPP	.69	1.84	1.80	.68	2.23	-2.01
			(.75)	(4.58)	(2.75)	(-2.68)
EUS	.71	2.19	1.84	1.04	1.02	-1.67
			(.26)	(3.16)	(2.41)	(-3.03)
Trading	.89	1.89	-1.04	.95	.65	-.82
			(-1.32)	(5.53)	(2.02)	(-1.78)
Shipping	.80	1.38	-1.39	1.07	.68	-.57
			(-2.02)	(3.65)	(2.74)	(-2.39)

Table 5.15 contd.

Industry	$\bar{R}^2$	D.W.	00	01	02	03
OCP	.88	2.36	-1.52	.79	1.40	-1.70
			(-.68)	(3.55)	(2.77)	(-1.78)
PCCEW	.89	1.41	-1.87	.78	2.39	-2.25
			(-1.84)	(6.47)	(1.85)	(-1.89)
RRP	.91	2.03	-1.61	.90	2.01	-1.93
			(-1.35)	(5.39)	(.05)	(-2.27)
PPP	.69	1.84	1.80	.68	2.23	-2.01
			(.75)	(4.58)	(2.75)	(-2.68)
EUS	.71	2.19	1.84	1.04	1.02	-1.67
			(.26)	(3.16)	(2.41)	(-3.03)
Trading	.89	1.89	-1.04	.95	.65	-.82
			(-1.32)	(5.53)	(2.02)	(-1.78)
Shipping	.80	1.38	-1.39	1.07	.68	-.57
			(-2.02)	(3.65)	(2.74)	(-2.39)

Let us discuss the results that were obtained through regression equations for each of 3 models separately and then collectively.

3.6. Modified Meltzer Model: The predictive power of regression equations, of the industries for which the modified Meltzer model has come out as the most relevant and significant economic model of business demand for money, ranges from .67 for the Coal Mining Industry to as high as .98 for the Medicines and Pharmeutical preparations industry with an average predictive power of .826 for the 17 industries.

The income elasticity of demand for money ranges from .58 for the 'Basic Industrial Chemicals' industry to 1.09 for the Medicines and Pharmeutical preparations industry with an average elasticity of .83. Significant economies of scale in holding cash balances are observed in all the industries except for 5 industries namely (i) Medicines and Pharmeutical preparations (ii) Transport Equipment (iii) Electricity Generation and Supply (iv) Trading (v) Shipping for which the elasticity coefficients are either slightly greater than unity or very near unity.

If we apply the statistical t' tests for testing the deviation of parameters of income elasticity from unity then we find that there are only 5 industries

whose elasticity is significantly less than one. These are (i) Silk, Rayon and Woolen textiles (ii) Electrical Machinery Appratus and Appliances (iii) Basic Industrial Chemicals (iv) Pottery China Clay and Earthen Ware (v) Paper and Paper products.

The elasticity of demand for money with respect to the proxy variable wealth-income ratio (W/Y) varies from .08 for the transport equipment to 2.39 for pottery, China clay and earthen ware, with an overall average value of 1.30. The elasticity coefficients are statistically insignificant for 6 out of 17 industries, namely (i) Coffee and Rubber plantations (ii) Silk, Rayon and Woolen Textiles (iii) Transport Equipment (iv) Electrical Machinery Apparatus and Appliances (v) Basic Industrial Chemicals and (vi) Rubber and Rubber Products.

With respect to the rate of interest elasticity coefficients, all the industries have statistically significant coefficients. The value of the elasticity coefficient ranges from -.57 for shipping to -2.25 for the pottery, China clay and earthen ware industry with an overall average value of -1.56.

3.7. Balance Sheet Approach Model: For five industries balance sheet model has come out as the most appropriate model of business demand for money (see table 5.16). The predictive power of this model ranges from .62 for Tobacco

industry to .93 for the foundries and engineering workshops industry with an average value of .75.

The income elasticity coefficient is statistically significant for all the industries. Its value ranges from .64 for 'other machinery' industry to 1.11 for tea plantations with an average of .876. For tea plantation and foundries&engineering workshops it is unity and for the rest less than unity.

The interest elasticity of demand for money is significant for all the 5 industries. Its value ranges from -1.07 for 'Tea plantations' to -2.30 for 'other machinery' with an average elasticity of -1.81.

The price level elasticity of demand for money has turned out to be insignificant for 3 of the five industries.Only for tea plantations and tobacco it has turned out to be significant. Its value ranges from .37 for foundries and engineering workshops to 1.17 for tea plantations with an average of 0.33.

The elasticity of demand for money with respect to rate of return on physical assets is significant for 3 of the 5 industries. Its value ranges from -.23 to -1.74 with an average of -1.04.

The elasticity of demand for money with respect to expected change in the general price level ranges from

-.48 for tea plantations to -2.84 for other machinery. Except for other machinery for all other industries this elasticity coefficient has turned out to be insignificant.

Thus even though the above model has performed better than other models for five industries in terms of $\bar{R}^2$, the crucial variables, namely price level and expected change in the price level which distinguish the balance sheet model from all other models have turned out to be statistically insignificant in the majority of industries.

3.8. Neo-classical Production Theory Model: The neo-classical production theory model has yielded good results for only 2 of the 33 industries namely Jute and Iron and Steel. But the predictive power of this model for Iron and Steel industry is low (.65). For both the industries only the real income has come out to be a significant variable. But here also they lead to different conclusions. On the one hand for Jute industry the elasticity of real demand for money with respect to real income is 1 meaning, the real demand for money as a productive input increases less than proportionately implying economies of scale, on the other hand the real demand for money for the Iron and Steel industry with respect to real income increases proportionately with real income thus invalidating the economies of scale hypothesis. The rate of interest turn out to be significant

only for the jute industry. Similarly (e/w) has turned out to be insignificant for Jute and significant for Iron and Steel industry. Both of them have insignificant elasticity coefficients for expected changes in the general price level and the securities price level (or capital gains).

Here it should be noted for the jute industry the interest elasticity of real cash balances (-2.24) is greater than their cross-elasticity with respect to e/w (-1.64) supporting Tobins (20) contention that substitution between liquid assets is greater than between money and physical inputs.

Finally let us see the frequency distribution of the elasticity coefficients of income, wealth-income ratio and the rate of interest for the 24 industries for which meaningful regression equations have come out

Table 5.18

Frequency Distribution of Elasticity Coefficients

	Below .5	.5 -1.0	1.0-1.5	Above 1.5
Income elasticity	-	18	6	-
(W/Y) elasticity	1	4	7	5
Interest elasticity	0	3	6	1?

We can use this income elasticity of demand for money as a criterion for dividing these industries into two main groups (i) those having economies of scale in cash balances which is shown by their income elasticity of money demand being less than one (ii) and those not having any economies of scale which is shown by their income elasticity being equal to unity.

Income elasticity .90	Income elasticity .90
Those industries who have economies of scale in holding cash balances	Industries which do not have economies of scale in holding cash balances
1. Coffee and Rubber plantations	1. Transport Equipment
2. Coal Mining	2. Medicines and pharmeutical preparations
3. Edible vegetable and hydrogenated oils	3. Rubber and Rubber products
4. Silk, Rayon and Woolen textiles	4. Electricity generation and supply
5. Aluminium	5. Shipping
6. Electrical machinery, apparatus and appliances	6. Tea plantations
7. Ferrous-non-ferrous metal products	7. Foundries and engineering workshop
8. Basic Industrial Chemicals	8. Iron and Steel
9. Other chemical products	
10. Pottery, China clay and earthen ware	
11. Paper & paper products	
12. Tobacco	
13. Cotton	
14. Other machinery	
15. Jute	

3.9. Reasons for Inter-Industry Differences: Even-though in this study we have not made any systematic attempt to deal with this aspect of the problem, we can give a few tentative plausible reasons which are subject to further empirical validation. They are

(i) One of the most important reasons would be the substantial inter-industry differences in the nature, extent and magnitude of use of trade credit in their transactions. Those industries which rely heavily on trade credit for their transactions and for whom short-term loans are readily or easily available from commercial banks and other financial institutions, the need for holding liquid cash will be low and their reactions to changes in rate of interest will be much more sensitive than those industries which do not depend on trade credit for their transactions and for which the dependence on self-financing to meet their short-term transactions, is very high.

(ii) The inter-industry differences may also be due to differencesin the size-structure of industries in terms of production, assets, the ratio of current assets to current liabilities etc.

(iii) Another reason could be the degree and nature of synchronization between income and expenditure streams which may be different for different industries. For example for an industry for whose products the level of

demand is the same throughout the year, the income stream will be more steady and certain than for an industry for whose product the demand is seasonal or subject to wide fluctuations.

IV. Conclusion:

From the analysis of disaggregate data performed above in terms of sectoral and industrial analysis we can infer the following!

5.4.1. There seems to be no essential conflict between the aggregate results and disaggregate results. At the disaggregate sectoral level the modified Meltzer model has come out as the most appropriate model of business demand for money irrespective of whether it is public limited or private limited. At the industry level disaggregation also in majority of industries the modified Meltzer model has come out as the best.

5.4.2. On the whole it appears that both at the sectoral and industrial level the results confirm that for many industries and sectors there exists economies of scale in holding cash balances.

5.4.3. The influence of changes in such variables as the capital intensity, rate of utilization of assets (or wealth) and the internal rate of return have been very well shown by the proxy variable namely wealth-income ratio. And this variable does influence the business demand for money very significantly.

(iv) Contrary to Milton Friedmans' contention that rate of interest does not influence the demand for money significantly, this variable has turned to be a very highly significant variable with high elasticity coefficients both at the sectoral and industrial levels.

(v) The neo-classical production theory approach of regarding money or real cash balances as a productive input is rejected by empirical findings. It is also found out that the influence of such variables as the factor price ratios, the general price level, expectations regarding the changes in the general price level and the security prices, have turned out to be very negligible and statistically insignificant.

CHAPTER VI

Conclusion

From the aggregate and disaggregate empirical econometric analyses that we have carried out in chapters IV and V based on the theoretical models of business demand for money discussed in chapter III, we can conclude the following:

(i) With regard to the question that we raised in chapter I as to whether there exists a stable business demand function for money and if so what are the key variables that appear in this, our answer is in the affirmative and the key variables that appear in it are (i) the current income (ii) the cyclical changes in the rate of utilization of assets, capital intensity and the internal rate of return; all of which can be effectively measured by the proxy variable wealth-income ratio (W/Y) (iii) the rate of interest on the money substitutes namely Government securities.

(ii) With regard to the question whether there exists economies of scale in holding money, the empircal findings both at the aggregate and disaggregate levels show that there exists significant economies of scale in holding money balances even though at the industry level disaggregation a few industires did not show it. The income elasticity of demand for money for a majority of industries

and sectors at the disaggregate level and for all five types of aggregates at the aggregate level comes out to be less than unity.

(iii) Empirically the most appropriate way of defining money would be in terms of a broader definition namely cash balances plus demand deposits plus time deposits with the commercial banks. Invariably for all the models the broader definition of money gives a better predictive performance ($\bar{R}^2$) and a more stable demand function.

(iv) The excellent performance of the modified Meltzer model in predicting the business demand for money both at the aggregate and disaggregate levels, shows the strong micro-economic foundations of the Meltzers' model in general.

(v) Contrary to Milton Friedmans' contention that the rate of interest is an unimportant variable in affecting the demand for money, we find our empirical findings emphasize that it is one of the most important variables which influence the business demand for money considerably which is shown by the higher elasticity it has (more than -1.5).

(vi) The effect of cyclical changes in such variables as, the capital intensity, rate of utilization of assets and the internal rate of return on the business demand for money has been aptly measured by our proxy variable wealth-income ratio (W/Y).

(vii) Our empirical study further points out that size and pattern of ownership (whether public limited or private limited or Government owned) do not influence the money demand function in any qualitative way. Only the estimated elasticity parameters differ slightly that too not statistically significant.

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Abreviations Used

JPE	:	Journal of Political Economy
JRSS	:	Journal of Royal Statistical Society
JF	:	Journal of Finance
IEJ	:	Indian Economic Journal
RESTAT	:	Review of Economics and Statistics
QJE	:	Quarterly Journal of Economics
YEE	:	Yale Economic Essays